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1. GENERAL ASPECTS

3532. Biomedical instrumentation used for modern health care - INSTRUMENTATION BIOMEDICALE UTILISEE POUR LES SOINS DE SANTE MODERNES - Padwo S. and Ross C.B. - Def. Personnel Support Cent., Philadelphia, Pa. 19101 - HOP.A PARIS 1971 6 (597-609)

One of the great illnesses of this century must be the multiplicity of documents, often very serious in character, generated by the health care delivery system. The literature deluge is absorbed, at least in part, by this concise review of the capabilities, costs, and availability of biomedical instrumentation used in modern health care in the U.S.A. The review precedes legislative recommendations directed to the General Administration of Public Assistance in France, the organ responsible for the solidification of hospital accreditation requirements.

1.2. Components

3533. A new method for evaluation of antithrombogenicity of materials - Imai Y. and Nose Y. - Div. Res., Dept. Artific. Organs, Cleveland Clin. Found., Cleveland, Ohio 44106 - J.BIOMED.MAT.RES. 1972 6/3 (165-172)

A new method was developed for evaluating kinetically the antithrombogenicity of materials. The amount of thrombus formed was measured gravimetrically at an appropriate interval of time after calcium chloride was added to ACD blood in contact with a test material. Graphic curves for thrombus formation on glass, Silastic, Hydron, and treated natural tissues were obtained and compared. There was good correlation between in vivo tests and in vivo observations.

3534. In vivo testing of silicone rubber joint implants for lipid absorption - Meester W.D. and Swanson A.B. - Med. Res. Dept., Blodgett Mem. Hosp., Grand Rapids, Mich. 49506 - J.BIOMED.MAT.RES. 1972 6/3 (193-199)

Silicone rubber implants removed from patients undergoing revision arthroplasty were examined for breakage and cracks and analyzed for lipid content. No relationship was observed between lipids extracted from the implants and the implantation time. Neither was the absorption of lipids and the incidence of breakage of the implants found to be related. Various factors contributing to the possible failure and breakage of the joint implants are discussed.

3535. The dermal toxicity of isoamyl 2 cyanoacrylate - Arthaud L.E., Lewellen G.R. and Akers W.A. - Med. Isot. Branch, Clin. Res. Support Div., Letterman Army Inst. Res., Presidio San Francisco, Calif. 94129 - J.BIOMED.MAT.RES. 1972 6/3 (201-214)

The results of tests suggest a potential for irritation and histotoxicity, and careful monitoring should be performed for any tests conducted with isoamyl 2 cyanoacrylate on man.

3536. Investigation of three surface properties of several metals and their relation to blood compatibility - DePalma V.A., Baier R.E., Ford J.W. et al. - Aeronaut. Lab., Cornell Univ., Buffalo, N.Y. 14221 - J.BIOMED.MAT.RES. 1972 6/4 (37-75)

Organic free specimens of 5 metals were prepared and characterized by parameters indicating their relative surface charge, surface texture, and surface energy prior to evaluation of their degree of thromboresistance. For the materials studied, there was no predictive correlation between the pre-implantation electrical rest potentials and ultimate thromboresistance when standard prosthetic rings were placed in the canine inferior vena cava. Surface textural inhomogeneities greater than a micrometer or so made thrombus formation a certainty. There was a positive postimplantation correlation between the presence of a thin, labile, proteinaceous deposit on the prosthetic ring lumens and the passivation of the 'high energy' materials towards thrombus accumulation. The metals which did consistently passivate, 316 Stainless Steel and Stellite 21, did so dynamically by acquiring an organic film within 2 hr after implantation. During continued residence in fresh, flowing blood these metals ultimately became dominated by an apparently monodisperse protein component of low critical surface tension. These findings were confirmed when thromboresistant pyrolytic carbon having initial surface properties similar to the metals but lacking reactivity and corrosivity was used as a comparison standard.

3537. Biopolymers as biomaterials. Mechanical properties of γ benzyl L glutamate L leucine copolymers - Anderson J.M., Hiltner A., Schodt K. and Woods R. - Div. Macromolec. Sci., Case Western Reserve Univ., Cleveland, Ohio 44106 - J.BIOMED.MAT.RES. 1972 6/4 (25-35)

A series of γ benzyl l glutamate l leucine copolymers were prepared and cast films of the copolymers were subjected to dynamic mechanical and stress strain tests. Dynamic mechanical testing revealed that the copolymers had a molecular relaxation at about 5

3538. Thermal and ionic methods of heparinizing small diameter dacron grafts - Hersh L.S., Gott V.L. and Najjar F. - Res. Lab., Corning Glass Works, Corning, N.Y. 14830 - J.BIOMED.MAT.RES. 1972 6/4 (85-96)

The Dacron grafts which had ionically bound heparin yielded the best results on both tissue and blood compatibility. The next best group was the thermally treated grafts from the TF series. Both types of successful grafts had an initial loading of about 1-2 mug heparin/cm^2 of Dacron. These grafts will be subjected to further animals tests before clinical studies will be started. The problem of increased transfabric bleeding through heparinized woven Dacron grafts described by Najjar and Gott will be attacked by the use of more tightly woven grafts. The next batch of heparinized grafts will involve specially woven grafts which have the water permeability reduced by about 80%.

3539. A study of FSK type photoresistors using low intensity modulated radiation - Rogovoy I.D.

and Kulish N.R. - SOV.J.OPT.TECHNOL. 1971 38/10 (583-585)

The conditions, method and results of studies of the absolute spectral sensitivity, volt ampere and luminous (watt ampere) characteristics, as well as certain other properties of FSK 1 and FSK 2 cadmium sulfide photoresistors, irradiated with low intensity (10^{-7} W) monochromatic modulated radiation at room temperatures, are described.

3540. Fundamental limitations in microelectronics. I. MOS technology - Hoeneisen B. and Mead C.A. - California Inst. Technol., Pasadena, Calif. 91109 - SOLID STATE ELECTRON. 1972 15/7 (819-829)

The physical phenomena which will ultimately limit MOS circuit miniaturization are considered. It is found that the minimum MOS transistor size is determined by gate oxide breakdown and drain source punch through. Other factors which limit device size are drain substrate breakdown, drain 'corner' breakdown and substrate doping fluctuations. However, these limitations are less severe than the oxide breakdown limitation mentioned above. Power dissipation and metal migration limit the frequency and/or packing density of fully dynamic and of complementary MOS circuits. In static non complementary circuits, power dissipation is the principle limitation of the number of circuit functions per chip. The channel length of a minimum size MOS transistor is a factor of 10 smaller than that of the smallest present day devices. The tolerances required to manufacture such a transistor are compatible with electron beam masking techniques. It is thus possible to envision fully dynamic silicon chips with up to 10^7-10^8 MOS transistors per cm^2.

3541. Ferroelectrics in optical memories and displays: A critical appraisal - Anderson L.K. - Bell Telephone Labs, Incorp., Murray Hill, N.J. 07974 - IEEE TRANS.SON.ULTRASON. 1972 SU-19/2 (69-79)

Ferroelectric materials can exhibit large electrooptic effects which can be made the bases of practical memory and display devices. Some of these are reviewed, with emphasis on those techniques which exploit optical sensing of polarization switching in matrix addressed arrays or ferroelectric photoconductor sandwich structures. Because of competition from other technologies, ferroelectrics are expected to be most successful in those applications which can take advantage of the unique combination of nonvolatility and large optical effect, but which do not require long term stability against disturb signals. Examples of such applications are use of a ferroelectric shutter array as a page composer in a holographic memory, and use of a ferroelectric photoconductor sandwich structure as a light valve in a slowscan graphics display.

3542. Low frequency white noise in reference diodes - Ringo J.A. and Lauritzen P.O. - Dept. Electr. Engin., Univ. Washington, Seattle, Wash. 98195 - SOLID STATE ELECTRON. 1972 15/6 (625-634)

The theory for the noise voltage in uniform avalanche diodes is extended to the low frequency case of small values of multiplication M and unequal hole and electron avalanche ionization coefficients. In the noise equivalent circuit the diode space charge resistance is in series with a noise voltage source. The results are compared in a survey of previous theoretical and experimental work. Further experiments on low voltage, mixed tunneling and avalanche breakdown diodes confirm the theory for small multiplication values.

1.3. Standards

3543. Another view of dimensions and dB - Ward W.W. - Lincoln Lab., Mass. Inst. Techn., Lexington, Mass. 02173 - PROC.IEEE (N.Y.) 1972 60/6 (743)

It was recently proposed to express watts per hertz in decibels as dBJ, or decibels referred to one joule. There is broad freedom to calculate logarithms and to assign dimensions. From this viewpoint, it makes sense to express Anything in decibels as dBA, or decibels referred to one Anything.

2. BIOPHYSICS AND BIOENGINEERING

3544. Hysteresis and molecular memory record - Katchalsky A. and Neumann E. - Polymer Dept., Weizmann Inst. Sci., Rehovot - INT.J.NEUROSCI. 1972 3/4 (175-182)

The problem of memory and learning is discussed on the basis of a concise review of present knowledge in this field of behavioral research. The results of a great variety of biochemical and biophysical studies support the current comprehension that biological information storage has a chemical molecular basis. Before a biosynthetic consolidation of phenotypic memory takes, however, place, there must be a physical interaction between the electric impulses of the neuronal network with an already existing molecular matrix. A mechanism proposed for fast imprint with low energy expenditure comprises conformational metastability (in certain cases leading to hysteretic phenomena) and conformational changes in macromolecules and macromolecular organizations such as membranes. Some physicochemical aspects of a molecular memory system are discussed and a biopolyelectrolytic model system is described.

3545. Path lengths and initial derivatives in arbitrary and Hessenberg compartmental systems - Hearon J.Z. and London W.P. - Math. Res. Branch, Nat. Inst. Arthr. Metab. Dis., NIH, Bethesda, Md. - MATH.BIOSCI. 1972 14/1-2 (121-134)

It is shown that if the matrix of an n compartment system is upper Hessenberg (zero entries below the subdiagonal) and nonzero initial conditions exist in the first compartment only, then the solution for the nth compartment is $\beta e_1 * e_2 * \ldots * e(n)$ where β is a constant, eit = exp(λit), λi is the ith root of the matrix and * denotes convolution. Conversely, the solution in a compartment can take this form only if the matrix of the system is Hessenberg (up to a permutational similarity). These results depend upon the relations which obtain among the distribution of zero entries in sequential powers of the matrix, the initial derivatives in the compartments, and the path length between compartments in the directed diagram of the system. These relations are developed and employed in an assessment of the product precursor criterion as proposed by Rescigno and Segre.

3546. Compartmental matrices with single root and nonnegative nilpotent matrices - Hearon J.Z. - Math. Res. Branch, Nat. Inst. Arthr. Metab. Dis., NIH, Bethesda, Md. 20014 - MATH.BIOSCI. 1972 14/1-2 (135-142)

It is shown that, as a consequence of the Frobenius theorem on nonnegative matrices, an n square compartmental matrix with a single n fold root is permutationally similar to a triangular matrix. As a result, certain properties of precedence matrices and some graph theoretic results can be viewed as essentially resulting from the classical theorem on nonnegative irreducible matrices.

3547. Compartment models in medicine - COMPARTMENTMODELLE IN DER MEDIZIN - Fuchs G. - Inst. Med. Statis., Freie Univ., Berlin - METH.INFORM.MED. 1972 11/3 (137-144)

The terms 'compartment' and 'compartment model' are defined and a list of possible types is presented. For a mathematical treatment of the problems 3 different groups of equations have to be formulated or postulated: balance equations, transient equations, model equations. Using these equations 3 different types of problems can be treated mathematically. In 5 examples taken from various fields in medicine the procedure of formulating a model and of calculating the model is demonstrated. Although strikingly different examples have been chosen, it is apparent that the mathematical treatment is similar in principle in all cases.

2.1. Fundamental concepts

3548. Analogues of classical limit theorems for the supercritical Galton Watson process with immigration - Heyde C.C. and Seneta E. - Australian Nat. Univ., Canberra - MATH.BIOSCI. 1971 11/3-4 (249-259)

It was shown that under standard conditions Xn/mn V>O with probability one, where (Xn) is a Galton Watson process with immigration, and offspring mean m>1. The authors obtain convergence rate results under additional conditions for this asymptotic behavior in the form of analogues of the central limit theorem and the law of the iterated logarithm, and similar results for the estimator Xn+r/Xn, which for fixed r ≧ 1 approaches mr with probability one.

3549. Local reverberations in the nervous system and memory - Ishihara T. - Dept. Mathemat. Sci., Univ. Osaka Pref., Osaka - MATH.BIOSCI. 1971 12/3-4 (225-233)

A model of short term and long term memory is presented based on the induction of local reverberations by another local reverberation by the extensive use of Caianiello's mnemonic equations.

3550. Model of cell contact (electrical properties) - Berkinblit M.B., Kovalev S.A., Smolyaninov V.V. and Chailakhyan L.M. - Inst. Problems Informat. Transmission, USSR Acad. Sci., Moscow - BIOPHYSICS (Oxford) 1971 16/3 (523-531)

For the elementary model of cell contact (contact membranes - flat discs uniform in resistance) the authors studied the behaviour of the transfer coefficient of potential from one cell to another. The authors determined the dependence of the transmission coefficient on the resistance of the external membrane and the parameters of the zone of contact (resistance of the contact membrane, specific resistance of the medium in the gap, the width of the intercellular gap, the radius of the region of contact). It was shown that the release of substances having a high specific resistance, for example, fats into the gap separating the cells may be an effective way of increasing the electric coupling between them. The transmission coefficient of potential for a column of contacting cells was determined. This makes it possible to determine how the attenuation of the potential in the column of cells depends on the parameters of their external membranes and the parameters of the zone of contact. It has been shown that in a column of cells the transmission coefficient has a maximum equal to 0.2-0.3 for a resistance of the contact membrane of 0.5-1 $.cm^2$.

3551. Some statistical aspects of point counting technique in plane sampling - Hsi B.P. - Sch. Publ. Hlth, Univ. Texas, Houston, Tex. - J.BIOMED.SYST. 1971 2/7 (3-26)

This paper is concerned with estimating the proportion of the area in a plane surface having a given characteristic. For example, in a plane surface composed of two types of districts, such as many irregularly shaped districts coloured either black or white, one is interested in the total area of the black districts. The total surface is divided into many areas of unit size and a sampling 'point' in each of the unit areas is identified as black or white. A probability model is developed for the estimation of the proportion of the total area which is black. Problems relating to size of the sample 'points' and their spatial arrangement are then explored based on this model. An important advantage of the proposed model is that the variance of the proportion is relatively easy to approximate when compared to other models. The estimator of the variance is numerically compared with that of other models and is shown to be equivalent to them.

3552. A study of statistical pattern verification - Jayant N.S. - Bell Telephone Lab., Inc., Murray Hill, N.J. 07974 - IEEE TRANS.SYST.,MAN,CYBERN. 1972 SMC-2/2 (238-246)

A decision theoretic approach to the problem of verifying that a given observation 'belongs' to a claimed pattern is examined. The problem presupposes a nonzero probability of impersonations, and verifier actions are ternary in general: a claimed identity is either accepted or rejected, or it 'blanked' 'blanked'when the verifier refuses to take either of the actions. Corresponding costs-of-wrong decision will be typically different in applications like speaker verification. We characterize sample observations by normal distributions and provide explicit results for the analytically simple situation of 'efficient' measurements whose interpattern variances are much greater than their intrapattern variances. In our specific model this will imply that the pdf of a measurement under the 'impersonator' hypothesis is 'diffuse' in relation to the pdf of the same measurement under any of several 'true pattern' hypotheses. It is demonstrated that the likelihood ratio function, in a typical verification task, possesses a finite upper bound and that this is related to a certain threshold effect for verifier decisions. The suitability of a minimax strategy for verification is mentioned and its performance is compared with those of optimal (minimum cost) and maximum likelihood procedures for the binary decision (accept or reject) problem. Numerical examples illustrate the minimax performance as a function of a parameter which reflects the peculiarity of the claimed pattern, and of the measurement dimensionality. Finally, the application is indicated of sequential hypothesis testing to a variable time for decision verifier designed to provide a prespecified performance, and note that in this model the expected time for decision is typically greater when the true pattern is the claimed identity than when it is an impersonation.

3553. Topics in pharmacokinetics. IV. Approximation in process space and fitting by sums of exponentials - Bellman R. - Dept. Math., Univ. South. California, Los Angeles, Calif. 90007 - MATH.BIOSCI. 1972 14/1-2 (45-47)

The approximation of a function by a sum of exponentials may be carried out effectively in some cases by associating the function with a process. This provides a useful parametrization for the coefficients and exponents.

3554. Empirical study of a non Markovian epidemic model - Yang G.L. - Univ. Maryland, College Park. Md. - MATH.BIOSCI. 1972 14/1-2 (65-84)

A stochastic model was constructed by the author in an earlier paper to describe the spread of an epidemic in a finite homogeneous population subject to a non Markovian type of epidemic. Based on this model asymptotically optimal tests were derived to test for contagion of the disease. The purpose of the present paper is to illustrate the use of such optimal tests by applying them first to some observed data of Mastocytoma (mast cell tumour) and then to the simulated Mastocytoma data generated by using Monte Carlo method. The stochastic model from which the test criteria were derived, describes the temporal development of the epidemic by utilizing the occurrence times T_1,...,Tn of the infective cases. The transition phenomenon of the process is characterized by mutation and contagion. The essential feature of the model is that the infectiousness of a diseased individual depends not only on the length of time he has been sick but also on the time at which he caught the disease. These characteristics are described in the model by a contagion function f. In the present paper, contagion functions of the indicator type were used to perform the test for contagion of Mastocytoma. The simulated data are used to study the convergence rate of the distribution of several test statistics to the limiting normal distribution; these results are compared numerically. It is found that one particular test statistic W_3 always gives better normal approximation than the others. The asymptotic power is calculated, its sensitiveness with respect to the choice of the contagion function is also discussed. The test result of the observed data, which consists of 174 cases recorded in two countries over two years, does not indicate the presence of contagion.

3555. On the functional significance of some geometrical parameters of hair cell cilia arrays - Marples V. - Univ. Warwick, Coventry - MATH.BIOSCI. 1972 14/1-2 (85-112)

An analysis of the behaviour of isolated cantilevers and of two dimensional groups of cantilevers simulating hair cell cilia arrays is described. Based on elementary beam bending theory, the method shows differences in static performance between uniform and tapered cantilevers and between arrays of equal and varying height cilia which reveal both the merit and the disadvantage of naturally occurring forms of cilia array. Despite the simplicity of the method and the qualitative nature of results it provides a valuable aid to understanding some of the hitherto unexplored mechanical aspects of auditory transduction. It also gives clear indication of the type of data required from morphological examination before the quantitative aspects can be finalized.

3556. Autonomous state classifications by dynamical systems - Rosen R. - Cent. Theoret. Biol., State Univ. New York, Buffalo, N.Y. - MATH.BIOSCI. 1972 14/1-2 (151-167)

A number of key areas of theoretical biology involve essentially similar formalisms and treat essentially similar questions; among these areas are the theories of (microphysical) measurement, pattern recognition, classification and discrimination mechanisms, and pattern generation. It is pointed out that, in each of these areas, we must ultimately deal with a dynamical system which is, in some sense, classifying its own states in an unambiguous way, on the basis of its intrinsic autonomous dynamics. We call such systems autonomous state classifiers; we characterize these systems mathematically and deduce a number of their elementary properties. The manner in which these properties manifest themselves in the areas of theoretical biology enumerated above is also briefly discussed.

3557. A method of improving the statistical accuracy in lifetime measurements on positrons annihilating in gases - Coleman P.G., Griffith T.C. and Heyland G.R. - Phys. Dept., Univ. Coll., London - J.PHYS.E.SCI.INSTRUM. 1972 5/4 (376-378)

A description is given of a method of improving the statistical accuracy in the measurement of the life time of positrons and positronium in gases. This is achieved by using a thin scintillator for direct detection of the positrons before they enter the gas. A new system of electronics involving the vetoing of prompt events is also described and some preliminary results for lifetime measurements are quoted.

3558. Epidemic simulation for training in public health management - Swain R.W., Lynn W.R., Hodgson T.A. et al. - Cent. Environm. Qual. Management, Cornell Univ., Ithaca, N.Y. 14850 - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (120-125)

Epidemiological simulation models to be used primarily to augment the teaching of epidemiology to medical students and other individuals concerned with public health and control of epidemics are presented. Interactive simulations are used to expose students to 'realistic' epidemic situations and permit them to experiment with various control strategies. Criteria by which simulations for such teaching purposes may be evaluated are proposed and operating simulations, Measles and Influ, are described in detail. Information is provided regarding user experience with the above simulations.

3559. Statistics making the optimum estimate linear - Bolgiano Jr L.P. - Dept. Electr. Engin., Univ. Delaware, Newark, Del. 19711 - PROC.IEEE 1972 60/4 (449)

It is shown that for counts scattered about a true signal value in accord with the Poisson probability distribution, the optimum linear signal estimate is identical to the optimum nonlinear estimate if the signal has a gamma probability density.

3560. An advantageous method of performing cross correlational analyses - Weinstein F.S. - PROC.IEEE 1972 60/4 (449-450)

A new interpretive approach to cross correlational analyses is introduced that is computationally simple and which provides results dependent on the signal to noise ratio at only one frequency of the harmonic components of the signal received. A simple example is included to demonstrate the technique.

3561. Sampling rate restrictions for exponential signal reconstruction - Fairman F.W. and Gupta R.D. - Dept. Elec. Engin., Queen's Univ., Kingston - PROC.IEEE (N.Y.) 1972 60/6 (726)

Restrictions on the sampling rates used to reconstruct signals consisting of a weighted sum of exponentials are derived by examining those sampling frequencies which produce pole zero cancellations in the Z transform of the signal being sampled.

3562. Optical determination of the correlation coefficient - Nyberg S. - Res. Inst. Nat. Def., Stockholm - OPTICA ACTA 1972 19/3 (195-201)

Correlation is a measure of similarity between two images. Maximum correlation occurs when the two images are identical. An optical method for the measurement of the correlation coefficient is described. The method uses the intensity transmission of the images. In order to get the value unity for the correlation coefficient for two identical images, normalization is used. Experiments give estimated values of accuracy and precision of about 4%.

3563. Decoupling multivariable systems by state feedback: sensitivity considerations - Tripathi A.N. - Dept. Electr. Engin., Inst. Technol., Banaras Hindu Univ., Varanasi - PROC.IEE 1972 119/6 (737-742)

The paper considers the effect of parameter variations in a linear, time invariant multivariable system $dx/dt = Ax + Bu$, $y = Cx$ which can be decoupled into noninteracting single input/single output subsystems by state variable feedback. Variations in the elements of the plant state matrix may cause the decoupled system either to remain decoupled with altered subsystem transfer functions, become recoupled with the subsystem transfer functions unaltered, or become recoupled with altered subsystem transfer functions.

3564. Relations between Haar and Walsh Hadamard transforms - Fino B.J. - Elec. Eng. Comput. Sci. Dept., Univ. California, Berkeley, Calif. 94720 - PROC.IEEE (N.Y.) 1972 60/5 (647-648)

Relations between the Haar and Walsh/Hadamard (W/H) transforms, which are proved, show that for some applications the Haar transform performs as well as, and faster than, the W/H transform. These relations yield a family of orthogonal transforms including the Haar and W/H transforms with a common fast algorithm.

3565. Fixed interval smoothing for nonlinear continuous time systems - Anderson B.D.O. - Dept. Electr. Engin., Univ. Newcastle - INFORMAT.CONTR. 1972 20/3 (294-300)

An equation is derived for the probability density of the state of a nonlinear dynamical system, conditioned on measurements over a fixed interval. In deriving the equation, the conditional Fokker Planck equation yielding the probability density of the filtering problem is used several times in a novel way.

3566. Limiting of signals in random noise - Jain P.C. - Stanford Res. Inst., Arlington, Va. 22209 - IEEE TRANS.INFORM.THEORY 1972 IT-18/3 (332-340)

The effect of ideal bandpass limiting on a signal lying in narrowband Gaussian noise is analyzed. General analytic expressions for the limiter output components are derived using an integral representation for the limiter characteristic. This method allows retention of the phases of all the signals and the intermodulation products at the limiter output, which are destroyed in the characteristic function method generally used in limiter studies. Expressions for the desired signals and intermodulation product amplitudes are obtained for the case when the limiter input consists of three angle modulated sinusoids and noise. The analysis is extended to n modulated sinusoids plus noise, and approximate expressions for the signal, intermodulation product, and noise terms are derived. Numerical results are presented for the signal suppression and the limiter output signal amplitudes for the case of three input signals, two of equal amplitude.

2.2. Mechanical systems

3567. Changes in the degree of orientation of bone materials with age in the human femur - Chatterji S., Wall J.C. and Jeffery J.W. - Dept. Crystallography, Birkbeck Coll., London - EXPERIENTIA (Basel) 1972 28/2 (156-157)

X ray diffraction patterns of 20 femurs from individuals aged from 6 days to 76 yrs were studied. Photographs were taken of the posterior and anterior quadrants. The results indicate that the apatite crystals of the bone of a newborn infant are orientated at random, whilst those in adults show stress induced orientation.

3568. The contractility of the myocardium. General aspects - LA CONTRACTILITE MYOCARDIQUE, ASPECTS GENERAUX - Haissly J.C. and Vandermoten P. - Clin. Cardiol., Hop. Univ. St Pierre, Bruxelles - ACTA CARDIOL. (Brux.) 1972 27/2 (111-131)

Hill proposed a model to explain the mechanical activity of the skeletal muscle. In this model, a contractile element (CE) is arranged in series with an elastic component SE. In parallel with these two components is another elastic component PE. CE is characterized by the hyperbolic force velocity curve which is altered by changes in the initial length of the muscle. This model can be used with the cardiac muscle, but the force velocity curve of the myocardium is also altered by changes in the level of its contractile state. The peak velocity defined by this curve, Vmax, is altered by changes in the level of the contractile state but is independent of the initial muscle length. Measurement of Vmax in the intact left ventricle makes it possible to detect a cardiac dysfunction before any alteration of its performance as a pump. Some theoretical and practical problems remain.

3569. Validity of simple physical models in interpreting maximal expiratory flow volume curves - Clement J. and Van De Woestijne K.P. - Lab. Longfunctieonderzoek, Akad. Ziekenh. St. Rafael, Leuven - RESP.PHYSIOL. (Amst.) 1972 15/1 (70-86)

The effort independent portion of the maximal expiratory flow volume (MEVV) curve can be described by means of simple equations representing one compartment physical models, based on Mead's equal pressure point (BPP) concept. Three such descriptions have been tested on flow volume curves obtained in 17 healthy individuals during forced expiratory maneuvers. The experimental curves were compared with the theoretical ones by means of statistical methods of best fit. A linear relationship between flow and volume fits the data satisfactorily and allows for calculation of an average resistance of the upstream segment. On the contrary, a quadratic expression relating flows to volumes, as well as several equations containing a second power in flow (in order to account for convective accelerative and turbulent losses), though giving a better fit, cannot be accepted because the values of the model's parameters, obtained after fitting, are not in conformity with their required physical meaning. The study suggests that the latter models are not satisfactory because the relationships between upstream airway resistance and volume are complex. If so, a model taking into account the compliance characteristics not only of the airway segment upstream from EPP, but of the total bronchial tree might be more successful in describing the MEVV curve.

3570. Quantification of sway in standing humans - Scott D.E. and Dzendolet E. - Dept. Electr. Engin., Univ. Massachusetts, Amherst, Mass. 01002 - AGRESSOLOGIE 1972 13/sp.nrB.(35-40)

The sway transducer is a square wooden platform, 68 cm wide and 2 cm thick. It is supported at the center of each side by the ends of four horizontally positioned stell bars extending under the platform. The platform is fastened to the bars by machine screws, with other ends of the bars rigidly fastened to a welded steel framework beneath the platform. Strain gauges are placed on each of two opposing bars, and connected electrically as elements of a WHEATSTONE bridge. Currently, the subject is positioned so that only his lateral sway influences the gauges. The output of this bridge is amplified and stored by means of FM magnetic tape recording. The record is later converted to digital form by using a PDP 8/I computer, and the result is subjected to a power spectral density (PSD) analysis by a CDC 3600 general purpose computer. The subject stands upright in stockinged feet, with eyes closed, and carries out mentally the multiplication tables. Three 4 min periods separated by 15 min rests are recorded. A PSD analysis is carried out on each 4 min period, and combined with the others to give a mean, which is displayed as a PSD vs. frequency plot, (0.04 2.5 Hz). The results indicate that in the frequency range studied, and with the subject in the 45° position, the characteristics of the neuromuscular system involved are those of an overdamped second order control system.

3571. The biomechanics of the temporomandibular joint: a theoretical study - Barbenel J.C. - BioEngin. Unit, Univ. Strathclyde, Glasgow - J.BIOMECH. 1972 5/3 (251-256)

An analysis of the force actions at the temporomandibular joint is presented. The solutions of the equations obtained are explored using linear programming methods to determine the minimum joint forces as a function of occlusal load.

3572. In vivo bone strain recorded from thoracic vertebrae of sheep - Lanyon L.E. - Dept. Veter. Anat., Univ. Bristol - J.BIOMECH. 1972 5/3 (277-281)

An investigation is reported in which semiconductor strain gauges were bonded with acrylic adhesive to the bone of thoracic vertebral bodies in live sheep. Recordings of strain change were taken during the animal's activity on a moving belt. These indicated that the bone was never static but constantly subject to cyclic deformation during respiration and locomotion.

Considerable similarities existed between the respiratory and locomotory strain change patterns of different sheep and between these data and those from a similar series in the lumbar region. Strain amplitude and strain rate increased with the animals' speed during locomotion and were comparable to values obtained from other regions.

3573. Structural mechanics of the mitral valve: stresses sustained by the valve; non traumatic determination of the stiffness of the in vivo valve - Ghista D.N. and Rao A.P. - Biomed. Engin. Progr., Washington Univ., St. Louis, Mo. 63130 - J.BIOMECH. 1972 5/3 (295-307)

In order to provide the requisite structural strength for a prosthetic mitral valve, we the authors analysed the stresses in the in vivo mitral valve leaflets during a cardiac cycle. The valve cusps of the mitral valve are analysed as two semi circular membranes held along the circular (fibrous valve ring) edge and supported along the straight edge (by the chordea tendinae).l8w13=performed. The critical loading condition is just prior to opening of the aortic valve, when the distended mitral valve leaflet is subject to the pressure difference between the left ventricular and left atrial chambers. For an adverse physiological loading situation, our analysis indicates that the order of magnitude of the stress that the leaflet membrane (and hence the prosthetic valve leaflet) sustains is $2.2X10^6$ dyn/cm^2. A vibrational analysis of the mitral valve leaflet is permormed. Expressions for the stress in the leaflet and Young's modulus of the leaflet material are obtained in terms of the dimensions of the valve leaflet and its fundamental mode vibrational frequency. The latter can be evaluated by determining the corresponding frequency of the first component of the first heart sound. The analysis made it possible to determine the stress in the leaflet and the Young's modulus (stiffness) of the in vivo leaflet at the instant of occurrence of the first heart sound. It is noted that at this instant the valve is strained up to the transition point of its typically non linear stress/strain characteristic. Prior to this instant, in a typical heart cycle, the valve operates in the pre transition stress/strain range and subsequent to this instant, it operates slightly above the transition point, reaching a strain of the order of 25% in adverse situations.

3574. A note on the elasticity of soft biological tissues - Demiray H. - Dept. Civ. Engin. Engin. Mechan., Hamilton - J.BIOMECH. 1972 5/3 (309-311)

In this note a simple possible form of the strain energy function for soft biological tissues is studied.

2.4. Bioacoustics

3575. Duration of discrimination of noise and tone bursts - Abel S.M. - Univ. California San Diego, La Jolla, Calif. 92037 - ACOUST.SOC.AMER. 1972 51/4(II) (1219-1223)

This research investigates the human observer's ability to discriminate a difference in duration for noise bursts and gated sinusoids. Two observers compared two durations T and T + ΔT in a two alternative forced choice procedure. The value of T ranged from 0.16 to 960 msec. For each T the value of ΔT for 75% discrimination was determined. The results showed that for most of the range investigated ΔT was proportional to T1/2. Performance was not affected by a change in bandwidth from 3500 to 200 Hz. Values of ΔT for 75% correct did decrease, however, when the observers were given audible spectral cues from very short pulsed sinusoids. The theory best describing the results was the neural counter model proposed by Creelman.

3576. Intensity discrimination of pulsed sinusoids: the effects of filtered noise - Viemeister N.F. - Dept. Psychol., Univ. California, San Diego, La Jolla, Calif. 92037 - ACOUST.SOC.AMER. 1972 51/4(II) (1265-1269)

It has been shown repeatedly that Weber's law does not hold for intensity discrimination of pulsed tones. The masking function fore such waveforms (10 logΔI vs 10 logI, for constant performance) typically is linear with a slope of 0.9 over a range in I of at least 60 dB. The present experiment indicates that the slope of the masking function increases from 0.9 to 1.0 as regions above the signal frequency are masked by filtered noise. A sufficient condition for a slope of 1.0 is a high pass noise which masks regions at and above the second harmonic of the signal. This suggests that the 'near miss' to Weber's law reflects the observer's use of information at aural harmonics. A model based upon this notion gives a good quantitative account of the data. The amount of distortion assumed in the model is in reasonable agreement with other data.

3577. On the perception of temporal phenomena in speech - Huggins A.W.F. - Res. Lab. Electron., Massachusetts Inst. Technol., Cambridge, Mass. 02139 - ACOUST.SOC.AMER. 1972 51/4(II) (1279-1290)

Experiments were performed to test whether a change made in the duration of one segment in a naturally produced sentence should be compensated in an adjacent segment if the sentence is to remain temporally fluent. The results showed that compensation is required between some pairs of segments, but not between other pairs, depending on where the two segments occur with respect to word and syllable boundaries. The results suggest that the perception of timing in natural speech is based on events at the syllabic level rather than at the segmental level, and that it is important to maintain the rhythm of the sentence, as defined by the onsets of vowels (especially stressed vowels), if the sentence is to sound temporally fluent.

3578. Preceding vowel duration as a cue to the perception of the voicing characteristic of word final consonants in American English - Raphael L.J. - H.H. Lehman Coll., City Univ. New York, Bronx, N.Y. 10468 - ACOUST.SOC.AMER. 1972 51/4(II) (1296-1303)

A number of studies in the literature have stated that the duration of a vowel is a significant cue to the voicing characteristic of the consonant that follows it. The present study investigated the effect of varying preceeding vowel duration upon the perception of word final stops, fricatives, and clusters in synthetic speech. A variety of minimal CVC (C) pairs was synthesized and the vowel of each was varied over a range of values derived from durations found in real speech samples. It was found that, regardless of the cues for voicing or voicelessness used in the synthesis of the final consonant or cluster, listeners perceived the final segments as voiceless when they were preceded by vowels of short duration and as voiced when they were preceded by vowels of long duration. Discrimination tests revealed that when the voicing characteristic is cued by vowel duration, perception is continuous rather than categorical.

3579. Effect of interaural switching on the recognition of speech sounds - Rupf J.A., Hughes G.W. and House A.S. - Purdue Univ., Lafayette, Ind. 47907 - ACOUST.SOC.AMER. 1972 51/4(II) (1304-1308)

The intelligibility of nonsense syllables was investigated as a function of the place in the speech waveform where the signal was switched from one ear to the other. The results demonstrated that the place at which switching occurred had essentially no effect on the identification of either the consonants or the vowels in the stimuli. In view of these findings it is unlikely that phonological rules are applied before the signals to the two ears are combined in the auditory system.

3580. An analysis of lesion development in the brain and in plastics by high intensity focused ultrasound at low megahertz frequencies - Robinson T.C. and Lele P.P. - Massachusetts Inst. Technol., Cambridge, Mass. 02139 - ACOUST.SOC.AMER. 1972 51/4(II) (1333-1351)

Thermal factors are believed to play a dominant role in the development of the structural and functional effects of irradiation of the nervous system with focused ultrasound at low megahertz frequencies. Similar mechanisms are postulated to underlie the effects of irradiation in methacrylate, which is frequently used as a test material to evaluate the influence of various factors on the results obtained. This study was undertaken to determine if thermal mechanisms alone can explain the development of trackless focal alterations (lesions) and all of their measurable characteristics in plastic as well as in brain. A purely thermal model is assumed and analytical prediction of lesion development and lesion size and shape for varying values of ultrasonic and thermal constants and controllable variables (frequency, focusing, dosage, target depth, etc.) is attempted. An empirical equation to describe the axial and radial ultrasonic energy distribution at the focus in water is derived. Appropriate heat transfer equations are developed for temperature distributions resulting from ultrasonic irradiation. The computed temperature profiles are plotted against nondimensionalized parameters. Temperatures at the lesion boundary were determined experimentally. Lesion dimensions read off the computed temperature profiles at the measured lesion boundary temperature are compared with experimental data. Agreement of analysis and data shows that, within the range of ultrasonic parameters used in this study, the development of lesions in the brain are explained by thermal mechanisms.

3581. A digital computer simulation of the human speech production mechanism - Obenour J.L. and Levy D.M. - Electr. Eng. Dept., Univ. Iowa, Iowa City, Ia. 52240 - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (114-119)

A simulation of the human speech production mechanism is described and its application to the area of biomedical teaching is indicated. For the group of students interested in the clinical and scientific areas of speech work, the simulation is particularly useful for showing how various parameters affect speech outputs, and also for helping estimate parameter values that cannot be measured directly. For students of bioengineering, the model and simulation is valuable for illustrating techniques of simplifying complicated physiological systems and actually carrying out the data of a real world simulation. The model used in the authors' work divides the speech generation into 4 distinct portions: the lungs bronchi trachea which serve as a pressure source; the larynx which provides the oscillatory mechanism; the vocal tract which serves to shape the audible signal produced by the larynx; and the mouth opening which serves to interface the vocal tract with the air outside. Since the above model has been implemented using the IBM System/360 Continuous System Modeling Program (CSMP), it is very easy to demonstrate effects of changing various parameters on the waveshape produced by the system, and to introduce structural changes in the model corresponding to newly obtained physical data or refinements in the mathematical models of the various subsystems. Because CSMP is an application oriented language, the user can concentrate his efforts on the details of the system he is studying rather than worrying about subtleties of numerical analysis and programming. This is a particularly relevant consideration in discussing simulation for biomedical applications.

3582. Comment on 'intracochlear potential recorded with micropipets. III. Relation of cochlear microphonic potential to stapes velocity' - Price G.R. - Hum. Engin. Lab., US Army Aberdeen Res. Developm. Cent., Aberdeen Proving Ground, Md. 21005 - J.ACOUST.SOC.AMER. 1972 51/6 II (2059-2061)

It is argued that the approximately constant relationship of cochlear microphonic output to stapes velocity noted by Weiss, Peake, and Sohmer is probably a function of a bias introduced by the choice of electrode location, i.e. the bone near the round window. Based on recordings from the round window, cochlear microphonic output rises about 20 dB between 100 Hz and 10 kHz if stapes velocity is held constant.

3583. Relationship between zero crossing measurements for speech analysis and recognition - Ito M.R. - NRC, Ottawa -

J.ACOUST.SOC.AMER. 1972 51/6 II (2061-2062)

Three types of zero crossing measurements, (1) average zero crossing rate, (2) density of time intervals between zero crossings, and (3) excess threshold duration, are related theoretically. It is shown that measurement types 1 and 3 can be derived from the type 2 measurement. Measurement types 1 and 3 cannot be directly related, but it is shown that the type 2 measurement can be derived from the type 3 measurement.

3584. Segmentation of utterances of a known phrase using linear threshold techniques - Das S.K. and Stanat D.F. - Syst. Develop. Div., IBM Corp., Research Triangle Park, N.C. 27709 - IEEE TRANS.AUDIO ELECTROACOUST. 1972 AU-20/2 (142-150)

A procedure utilizing linear threshold techniques for segmenting utterances of a single known phrase has been implemented. The technique utilizes several weight vectors derived in an iterative manner and temporal information between various designated speech events to perform segmentation. Accuracy results ranging from 100 to 92% have been achieved on nondesign data and are considered to be encouraging. Some remarks are included concerning means for strengthening these techniques and for applying them to other areas.

2.5. Biooptics

3585. Temporal discrimination of two pulse stimuli as a function of psychophysical method and luminance - Mertens H.W. and Lewis M.F. - Civil Aeromed. Inst., Oklahoma City, Okla. 73125 - J.OPT.SOC.AMER. 1972 62/6 (823-826)

Two experiments extended psychophysical methods of the theory of signal detectability (TSD) to the study of the temporal discrimination of brief two pulse visual stimuli. Experiment I tested the TSD prediction that observer sensitivity is independent of the psychophysical method used in measurement. Discrimination between a constant duration (interpulse interval) comparison stimulus (3 ms) and a variable duration test stimulus (7 - 32 ms) was measured with a two alternative forced choice (FC) procedure and a 'yes no' procedure. Sensitivity was comparable under the two psychophysical procedures, thus supporting the application of TSD in future studies of the sensory processes involved in discrimination of two pulse stimuli. Experiment II measured discrimination with the FC procedure at three luminance levels: 31.8, 318, and 3183 cd/m^2. Discriminability increased with luminance. This significant luminance effect is in agreement with the previous findings of Lewis and Mertens concerning the effect of luminance variation in the photopic range on two pulse thresholds.

3586. Basis functions of tristimulus coordinate spaces - Shapiro W.A. - Singer Co., Kearfott Div., Pleasantville, N.Y. 10570 - OPTICA ACTA 1972 19/3 (235-242)

A set of tristimulus coordinates is commonly characterized by its weighting functions, which span a three-dimensional subspace in the overall vector space of wavelength functions. This subspace also contains the weighting functions for all other tristimulus coordinates associated with the same standard observer. It is shown that the vector projections of reference stimuli spectra onto the subspace bear a special relation to the associated weighting functions. The projections of each triplet of reference stimuli constitute a basis of the subspace, and the tristimulus coordinates generated by the associated weighting functions are precisely the vector components over this basis. The basis functions for CIE 1931 tristimulus coordinates are shown.

2.6. Gas physics

3587. Interaction model between the circulatory and respiratory systems - Albergoni V., Cobelli C. and Torresin G. - Ist. Biol. Anim., Univ. Padova - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (108-113)

The present study was prepared in order to illustrate the gas exchange (O_2 and CO_2) between pulmonary blood and alveolar air. In the model, circulatory and respiratory systems have been separately simulated in order to obtain the driving functions of the interaction model. This last takes into account oxygen and carbon dioxide exchanges between alveolar air and pulmonary blood. The circulation model is simulated by an RLC network which has proper auto and mutual admittances. Cardiac pressures have been considered as driving functions and arterial and venous blood flows are so obtained. The respiratory model is simulated by a block, with proper resistance and compliance with respiratory muscle effort as a driving force and tidal volume as output function. The significant variables of the interaction model are alveolar air and pulmonary blood concentrations of O_2 and CO_2. These are determined from blood flows and tidal volume previously obtained and from gas diffusion across the alveolar membrane. The capillary bed is divided into a discrete number of cells and time in finite intervals and then the diffusion law is solved with a finite difference method. The particular interest of the method is in the step by step procedure which allows one to obtain a complex model from the combination of simpler models.

2.7. Fluid flow systems

3588. Construction and results of investigation of a quantitative model of the system of intracranial circulation - Kislyakov Y.Y. and Zelikson B.B. - Sechenov Inst. Evolut. Physiol. Biochem., USSR Acad. Sci., Leningrad - BIOPHYSICS (Oxford) 1971 16/2 (338-345)

On the basis of available physiological information using the main patterns of the functioning of the intracranial circulation system the authors have constructed a quantitative model - a model in which all the variables characterizing its behaviour are expressed in absolute units. Comparison of the results of experiments in animals with those of modelling made with the digital computer confirm the correspondence of the model to the actual specimen and enables the authors to embark on investigation of the model. As a result of modelling the authors established the quantitative dependence on the arterial and venous pressures of such parameters of the system of intracranial circulation as the volumetric speed of blood flow, blood filling of the cranial cavity and intracranial pressure.

3589. Cardiovascular system simulation in biomedical engineering education - Rideout V.C. - Dept. Electr. Engin., Univ. Wisconsin, Madison, Wis. 53706 - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (101-107)

A number of complex cardiovascular system models have been developed at the University of Wisconsin largely as a result of bioengineering thesis work carried on in the Department of Electrical Engineering, using a large hybrid computer. Other work in modeling includes parameter estimation study and the development of new methods of modeling. This work has been carried out in collaboration with research workers in Medical and Life Sciences Departments at Wisconsin. Courses in biomedical engineering have recently been established in the Department of Electrical Engineering at senior graduate and graduate levels. Some of these courses include the principles of development and use of models of the cardiovascular and other systems of the mammalian body. In the laboratory work associated with one of these courses, an attempt has been made to introduce the students to models of some considerable complexity. As an example of these new efforts, a cardiovascular blood pressure flow model, driving a compartment model for the study of dye transport, was set up on a hybrid computer for use in a laboratory exercise by students who did not have the computer experience or skill to be able to easily set up such a simulation (involving some 27 differential equations, running at 'real time' rate). The students were given detailed instructions regarding the model, and were then able to study effects such as those due to septal defects and valve defects upon the pressure, flow and dye dilution curves. The success of this experiment in the use of involved models in engineering courses was such that it seems that this type of laboratory exercise might be considered for use in physiology courses, as an adjunct to animal experiments.

3590. A simple heart model designed to demonstrate biological system simulation - Cook A.M. and Simes J.G. - Dept. Electr. Engin., Sacramento State Coll., Sacramento, Calif. 95819 - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (97-100)

A third order model of the cardiovascular system which is designed to illustrate biological system simulation to bioengineering students and to introduce the students to a maximum number of analog computer components is described. The extreme simplicity of the model allows the students to concentrate on the simulation and computation without the additional burden of physiological complexity. Heart pumping action is derived from a variable capacitor, and the systemic circulation is modeled as an RC filter. The data obtained from this model show good correlation with observed data. After presentation of this simple model in class, the students are asked to improve the simulation by including any or all of several improvements which are suggested in this paper.

3591. Computer aided medical instruction using an interactive graphics model of the normal and congenitally defective heart - Rupeiks D. - UCLA Sch. Dent., Los Angeles, Calif. - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (88-96)

The on line interactive graphics digital computer model of the normal and congenitally defective heart was developed as a basic research and teaching tool. The interactive graphics capability of the simulation system provides the user great flexibility in selecting the types of defects he wishes to study, and in allowing him to progress at his own speed. A brief discussion of the interactive graphics system and the modeling equations for the normal heart and congenital defect options: ventricular septal defect, patent ductus arteriosus, valvular stenosis, and valvular incompetence (regurgitation), are included.

2.8. Electrical systems

3592. On the transduction of visual, mechanical, and chemical stimuli - Dodge Jr F.A. - IBM Thomas J. Watson Res. Cent., Yorktown Heights, N.Y. 10598 - INT.J.NEUROSCI. 1972 3/1 (5-14)

The paper is designed to present the formulation of a compact description of the input output relations of a sensory receptor. A major thesis states that an adequate model of the receptor must account quantitatively for both the stimulus dependent component of the response and its randomly fluctuating, i.e., stochastic, component.

3593. Molecular approaches to neural coding - Ungar G. - Baylor Coll. Med., Houston, Tex. - INT.J.NEUROSCI. 1972 3/4 (193-199)

Information processing in the nervous system is based essentially on the existence of highly organized specific connections. While innate information is coded in terms of prewired circuits, learned information probably involves the creation of new connections between the existing pathways to establish an acquired circuit, representing the memory trace. The persistence of these circuits can be best explained by the formation of specific molecular markers. One of these coded substances has been isolated, identified as a pentadecapeptide and reproduced by synthesis.

3594. Anode break excitation in space clamped squid axons - Guttman R. and Hachmeister L. - Dept. Biol., Brooklyn Coll., City Univ. New York, Brooklyn, N.Y. 11210 - BIOPHYS.J. 1972 12/5 (552-563)

Strength duration curves for space clamped squid axons, using square wave anode breaks as stimuli, established the existence of 4 distinct regions. For the average experimental axon the intersection of the first 2 regions, tau 1, occurs at about 7 msec. This agrees with computations based on the Hodgkin Huxley (HH) equations and corresponds to the accommodation time constant found previously for a linearly rising ramp, as given by the HH equations and as found experimentally. The second break in the curve, tau 2, at about 200 msec, and the third break, tau 3, at 1 sec, are far beyond the range of the HH equations and may be the counterpart in the excitability of the long time constants, which have been apparent from a number of other types of experiments. The regions of the curve before 1 msec and beyond 2 or 3 sec are quite variable and may represent breakdown. Rheobase increases in both experimental and computed axons when temperature is raised. In both experimental and computed axons tau 1 decreases slightly when the temperature is raised from 10 to 15° C. At 20 and 25° C, tau 1 of the experimental axon increases markedly.

3595. Capability and limitations of electrocardiography and magnetocardiography - Plonsey R. - Dept. Biomed. Engin., Case Western Reserve Univ., Cleveland, Ohio 44106 - IEEE TRANS.BIOMED.ENGIN. 1972 19/3 (239-244)

The capabilities and limitations of electrocardiography and magnetocardiography are discussed. Representing the electrical activity of the heart by an impressed current density, electrocardiography determines the spherical harmonic multipole expansion of its divergence (flux source), while magnetocardiography determines the spherical harmonic multipole expansion of the radial component of its curl (vortex source).

3596. Causality or driving in electrophysiological signal analysis - Gersch W. - Informat. Sci., Univ. Hawaii, Honolulu, Hawaii 96822 - MATH.BIOSCI. 1972 14/1-2 (177-196)

A single time series is defined to be causal relative to other stationary time series if it uniquely explains the pair wise linear relationship between other time series. This definition lends itself to explicit statistical tests, to multivariate extensions of the definition of causality, to the case in which a linear combination of time series may be causal relative to other time series, and to the physical plausibility arguments considered essential in order to conclude that causality is present in time series. More specifically, consider 3 simultaneous time series (xt), (yt) and (zt). Assume that (xt), (yt) and (zt) have a 'significant' amount of energy over a common physically relevant frequency interval and that over this frequency interval there is significant spectral coherence between each pair of time series. Roughly, the spectral coherence is required to be substantially different than zero over the frequency interval of interest and not be spurious or due to other nonmeasured variates. One time series, say (zt), is causal relative to (xt) and (yt) if the partial spectral coherence between (xt) and (yt) conditioned (zt) is zero over this frequency interval and the partial coherences between (xt) and (zt) conditioned on (yt) and between (yt) and (zt) conditioned on (xt) are not zero over this same interval. If the unconditional coherence between 2 time series is nonzero and the coherence conditioned on a third time series is zero, then formally the third time series accounts for the linear relationship between the first 2 time series. Illustrative examples and practical applications are demonstrated.

3597. Spread of an impulse in a model of the nerve fibre - Aronov I.Z. and Kheifets L.M. - Mechanomathemat. Fac., Lomonosov Moscow State Univ., Moscow - BIOPHYSICS (Oxford) 1971 16/4 (766-768)

A simplified model is proposed for the spread of the nerve impulse in which the changes in ionic permeability are set by a length constant function. For this model analytically the authors obtained an expression for the velocity of spread of excitation in the homogeneous fibre and found the condition of blocking of the impulse at the site of widening of the fibre.

2.9. Nuclear biophysics

3598. Comparison of manual and computer evaluation of systemic plutonium burden - Bramson P.E., Jech J.J. and Andersen B.V. - Pacif. Northwest Lab., Battelle Mem. Inst., Richland, Wash. 99352 - HLTH PHYS. 1972 22/6 (911-920)

Six well documented plutonium exposure cases were evaluated manually at Hanford and by computer program at Los Alamos Scientific Laboratory and Oak Ridge National Laboratory. The systemic burden evaluations agreed within a factor of 2 for 5 of the cases and within a factor of 4 for the 6th case. Three cases had received varying degrees of chelation (DTPA) treatment but the evaluations did not appear to be differentially affected when compared to the untreated cases.

3. GENERAL INSTRUMENTATION

3599. A self contained, portable apparatus for preservation of donor kidneys - Hopkinson W.I., Littlewood F.R. and Snell M.E. - Vickers Res. Establishm., Sunninghill, Ascot - BIO-MED.ENGINEERING 1972 7/3 (110-115)

This paper describes a new, completely self contained, portable apparatus which can be transported by land, sea or air and is designed for use in organ exchange schemes. It operates virtually unattended for a period of 24 hours, and promising results have been obtained in the experimental preservation of dog kidneys.

3600. Use of strain gauge for measuring voltage - Singh V.R., Parshad R. and Gupta U.C. - Electron. Div., Nat. Phys. Lab., New Delhi - PROC.IEEE (N.Y.) 1972 60/6 (740)

The force of attraction between the

capacitor plates is used to measure voltage by making one of the plates deflectable under the force of attraction. A strain gauge mounted on this plate suffers a shear strain which is detected electrically by the conventional technique of the Wheatstone bridge followed by an amplifier. The output of the amplifier was found to be linearly related to the square of applied voltage between the plates, as it theoretically should be. The technique can be used to measure DC and AC voltages, particularly when their magnitudes are high and there is also high impedance.

3601. Interactive graphics technique for the design of single input feedback systems - Fallside F., Patel R.V. and Seraji H. - Univ. Engin. Dept., Univ. Cambridge - PROC.IEE 1972 119/2 (247-254)

The design technique is applicable to a large class of linear systems described by state equations or cascaded transfer functions. It is based on closed loop pole assignment which the designer performs by moving the system poles by means of the light pen. The program (SISD) calculates and displays the required feedback coefficients and then a variety of responses, transient and frequency, and further options can be displayed to allow the system performance to be assessed and modified if required. Computation times are very short, of the order of a few seconds, allowing truly interactive design. The technique is fairly general, allowing the use of complete or incomplete state or output feedback. Two illustrative examples are given.

3.1. Transducers

3602. High speed inexpensive photodiode assembly - McCall G.H. - Los Alamos Sci. Lab., Univ. California, Los Alamos, N.M. 87544 - REV.SCIENT.INSTRUMENTS 1972 43/6 (865-866)

A photodiode assembly is described which incorporates a Hewlett Packard 5082-4220 diode in an impedance matched holder to produce a unit with a rise time of approximately 100 psec and a fall time of approximately 300 psec. The assembly was designed for detecting fast laser pulses, but it can be used for monitoring any high speed optical signal.

3.2. Amplifiers

3603. An electrometer amplifier with low input capacitance and large input dynamic range - Holmer N.G. and Lindstrom K. - Dept. Electr. Measurements, Inst. Technol., Lund - IEEE TRANS.BIOMED.ENGNG. 1972 BME-19/2 (162-164)

An electrometer amplifier was designed for biologic research with the following characteristics: input resistance larger than 10^{12}; input current 10^{-12} A; low input capacitance; and an input dynamic range from 0 to ±7 V The input stage consists of JFET.

3604. A current recording unit for potentiostats - Brown O.R. - Electrochem. Res. Lab., Dept. Phys. Chem., Univ. Newcastle upon Tyne - J.PHYSICS E:SCI.INSTRUM. 1972 5/4 (365-368)

An instrument is described which enables cell currents to be recorded in analogue form by commercial recording equipment possessing a single input relative to earth, integrates these currents over any chosen period and converts the same currents to a logarithmic scale. The response and accuracy of the instrument are discussed. Cell currents of any magnitude below 3A are handled, although the logarithmic operation loses accuracy below 0.3 μA. The instrument can be used with most commercially available potentiostats.

3605. Chebyshev linear phase filter poles by interpolation - Humpherys D.S. - Dept. Elec. Engin., Brigham Young Univ., Provo, Ut. 84601 - PROC.IEEE (N.Y.) 1972 60/6 (725)

A simple interpolation formula is given to compute the pole locations of an all pole filter whose phase is linear in the Chebyshev sense. The interpolation formula gives good results for filters with 2-10 poles and peak phase errors between 0° and 1°. Fair accuracy is achieved for peak phase errors up to 5°.

3606. Instrumentation for measuring bioelectrical signals in plants - Karlsson L. - Phys. Lab., Roy. Veter. Agric. Univ., Copenhagen - REV.SCIENT.INSTRUMENTS 1972 43/3 (458-463)

An electronic instrumentation for the measurement of bioelectrical signals in plants is presented. The problems of common mode signal rejection and amplifier bias current are considered. With the instrumentation presented recordings have been made of bioelectrical signals generated in the India rubber tree (Ficus elastica).

3607. Oscillator circuit for a vibrating capacitor driven by an RF electric field - Van Nie A.G. - Philips Res. Labs, N.V. Philips' Gloeilampenfabr., Eindhoven - IEEE TRANS.INSTRUMENT.MEASUREMENT 1972 IM-21/2 (153-161)

The vibrating capacitor consists of a metalized membrane, clamped at its edges, between two electrodes. The membrane is driven by an RF electric field (309 kHz), which is amplitude modulated at the natural frequency (6 kHz) of the membrane. This RF field is caused by a voltage applied to one of the electrodes, which, together with the membrane, forms the driving capacitor. The other electrode, and the membrane, constitute the vibrating capacitor. A special RF oscillator has been designed, of which an essential part is the driving capacitor. This capacitor causes the RF voltage to be amplitude modulated at the natural frequency of the membrane. The oscillation conditions of this electromechanical system are derived from the equation of motion of the membrane and the electrical properties of the driving circuit. An oscillator circuit with optimum performance is designed with the aid of a computer. Finally, the computed results are verified by measurements.

3608. On designing sharp cutoff low pass filters - Agarwal M.C. and Sedra A.S. - Dept. Elec. Engin., Univ. Toronto - IEEE TRANS.AUDIO ELECTROACOUST. 1972

AU-20/2 (138-141)

Effects of introducing single or multiple pairs of coincident jω axis zeros in all pole Chebyshev filter transfer functions are investigated. It is shown that for the same order n, Chebyshev filters with finite jω axis zeros provide much sharper cutoff than all pole Chebyshev filters. It is also shown that for the same n, the same number of pairs of zeros m, and the same locations of zeros, the cutoff slope and stopband characteristic of the finite zero Chebyshev filters are much better than those of the finite zero Butterworth filters. Graphs helpful in the design of such filters have been plotted and their use is illustrated by an example.

3609. FETs remove transients from audio squelch circuit - Coers G. - Texas Instrum. Components Group, Dallas, Tex. - ELECTRONICS 1972 45/12 (102)

Using field effect transistors instead of bipolar transistors for an audio squelch circuit eliminates switching transients without sacrificing switching time. Moreover, because there are no transients, the circuit's frequency response can be as low as desired.

3610. Logic approach to time delay uses only integrated circuits - Carroll J.J. - US Nav. Avionics Facility, Indianapolis, Ind. - ELECTRONICS 1972 45/12 (120-121)

The checking of systems that use linear pseudo random pulse sequences usually requires delayed sequences, as well. Often the delayed signals are simulated by conventional delay lines, but this approach is bulky and expensive to implement, and changing the length of the delay requires switching several delay lines or using a tapped delay line. In a more compact and less expensive approach, several logic gates can delay the pulse sequence, which is produced in the conventional way by a modified shift register, and a second shift register varies the delay in much smaller increments than are practicable with conventional delay lines.

3611. Choosing MOSFET bias for minimum temperature drift - Baird D.W. - ELECTRONICS 1972 45/8 (115)

There is an easy way to calculate what gate bias voltage will keep temperature drift in MOSFETs as small as possible. The analysis applies to both saturated and triode regions of MOSFET operation, and works out the gate voltage value that minimizes any change in drain to source current due to small temperature excursions.

3.3. Indicators

3612. Regenerative shift registers as synchronous counters - RUCKGEKOPPELTE SCHIEBEREGISTER ALS SYNCHRONZAHLER - Mortier H. - ELEKTRONIK 1972 21/1 (16)

The basic element in every shift register is a special form of the multivibrator. The JK flipflop, the D flipflop and also the RS flipflop with adjustable periodicity may be used. It is less well known that a shift register with appropriate feedback may serve as a cyclic shift register or synchronous counter. Some illustrative examples are given.

3613. The structure related noise of fiber optic plates used as the faceplates of cathode ray tubes - Brushtunov V.Y. and Simkin Y.Y. - SOV.J.OPT.TECHNOL. 1971 38/8 (460-462)

The noise inherent in an 'ideal' model of fiber-optic plates with hexagonal packing was investigated analytically and experimentally.

3614. Tunnel diode transistor binary counter - Sarnot S.L., Gupta M.L., Srivastava A. and Bhattacharyya A.B. - Dept. Phys., Ind. Inst. Technol., New Delhi - PROC.IEEE 1972 60/4 (461)

The principle of operation and the performance of a binary counter using a tunnel diode in the collector emitter lead of a transistor is investigated. Simplified design procedure and lesser component configuration are the special features of the proposed hybrid binary.

3615. High resolution precision digital tachometer - Szabados B., Sinha N.K. and DiCenzo C.D. - Dept. Electr. Engin., McMaster Univ., Hamilton - IEEE TRANS.INSTRUMENT.MEASUREMENT 1972 IM-21/2 (144-148)

A new approach to the digital measurement of angular velocity is presented. This new instrument performs the division by time that has been carefully avoided in the existing instruments. The accuracy and resolution of the transducer does not depend upon the number of quantizations/revolution. The measurements can be made in a very short time, leading to up to 14,700 samples per second. An important feature of this instrument is that even at speeds close to zero (or at zero), the error is less than 0.02% and 1600 samples of the angular velocity can be obtained/second. This makes the instrument particularly suitable for the study and control of the transient behavior of motors and other rotating devices.

3616. Recyclable holographic storage media - Bordogna J., Keneman S.A. and Amodei J.J. - Moore Sch. Electr. Engin., Univ. Pennsylvania, Philadelphia, Pa. - RCA REV. 1972 33/1 (227-247)

Performance parameters of state of the art recyclable holographic recording media are compared to develop tradeoffs for their use in holographic storage and imaging applications. Included are record energy, record time, erase time, diffraction efficiency, linearity, resolution, cycle lifetime, natural decay time, and a figure of merit. Materials and devices discussed include: magneto optic, electro optic, and photochromic materials; metal films; ferroelectric photoconductor, thermoplastic deformation, elastomer, liquid crystal photoconductor, and photoconductor Pockel's effect devices.

3617. An automatic chart follower using electrically conducting ink - Collins A.T. and Fricker N. - Wheatstone Phys. Lab., King's Coll., London - J.PHYSICS E: SCI.INSTRUM. 1972 5/4 (304-305)

A system is described which enables an analogue signal in the form of a trace from a chart recorder to be automatically digitized. The trace is first copied with electrically conducting ink and then fed through the chart recorder again. The pen is replaced by a metallic probe and a simple circuit constrains the probe to follow the trace as it is driven through the recorder. The voltage applied to the recorder input is monitored with a digital voltmeter which has punched tape read out facilities, and sampled at equal time increments. The method requires only a small modification to the chart recorder, and is useful for digitizing old and perhaps unique records (geophysical data, for example, are of this type) as well as records whose quality is impaired by noise and spurious features. The method may also find application to digitization of records made on nonlinear chart recorders.

3618. Picking the right film for better oscilloscope pictures - Anwyl R.D. - Eastman Kodak Co., Rochester, N.Y. - ELECTRONICS 1972 45/8 (115-116)

There is no need to settle for less than top quality photographs from CRT displays. Eastman Kodak's new exposure index for recording films helps the engineer select the proper film. The index is based on simulated CRT exposures calibrated in radiometric units for three commonly used phosphor types: P 11 (blue), P 16 (near ultraviolet), and P 24 (green). But the difficulty in determining the precise transient output of a CRT prevents the new index values from being applicable in an absolute manner. However, they are useful for comparing the merits of several films that could be used.

3.4. Recorders

3619. Cardiac diagnostic equipment - Chapman W.E. - Sect. Int. Med., Palo Alto Med. Clin., Palo Alto, Calif. - POSTGRAD.MED. 1971 50/1 (41-42)

Four cases of Bowen's disease of the nail bed occurred. The clinical appearance of the lesion was characterized by either verrucose hyperplasia, fissures, or ulceration of the nail bed with destruction of the nail plate in the area. Treatment of choice is complete surgical excision of the nail bed and the nail matrix, if it is affected.

3620. Electric control of fluid jets and its application to recording devices - Hertz C.H. and Mansson A. - Dept. Electr. Measurements, Inst. Technol., Lund - REV.SCIENT.INSTRUMENTS 1972 43/3 (413-416)

A new method for the intensity modulation of ink jets used for recording of electrical signals is described. It uses the fact that a liquid jet ejected from a fine nozzle towards a recording paper is dispersed into a spray if an electric field is established near the nozzle. This allows the intensity modulation of the recording trace with frequencies exceeding 100 kHz. The use of this method in facsimile recording, graphic data displays, and alphanumeric printing devices is described briefly as well as results showing the capacity of the method.

3.5. Generators

3621. Simple pulse generator with variable on/off ratio - EINFACHER IMPULSGENERATOR MIT EINSTELLBAREM TASTVERHALTNIS - Herrmann P. - ELEKTRONIK 1972 21/1 (8)

The impulse generator described is designed for a very slow periodicity. It consists of a T1 unijunction transistor and a flipflop.

3622. Combination of a phase shifter with a frequency converter - ZUSAMMENARBEITEN EINES PHASENSPALTERS MIT EINEM FREQUENZWANDLER - Kron A.W. - Herdweg 103, Darmstadt - ARCH.ELEKTROTECH. 1971 54/4 (206-212)

An introduction on the application and an example of the problem are followed by a study on a frequency converter with symmetrical threephase loading with the aid of local diagrams for impedance and current. For the combination of a frequency converter with a phase changer the symmetrical components of the current are found by vector diagrams. Finally some experimental results concerning the effect of symmetrification methods are reported.

3623. One ampere current supply stable to one part per million per hour - Retsky M.W. and Wall J. - Enrico Fermi Inst., Univ. Chicago, Chicago, Ill. 60637 - REV.SCIENT.INSTRUMENTS 1972 43/3 (384-385)

A 1 A current supply stable to better than 1 ppm/h is described. The technique uses a standard feedback circuit, but many practical problems had to be solved to achieve the high stability. Details concerning a 10^{-3} °C stability oven, a 1 ppm/h variable reference voltage, and a 1 ppm/°C power resistor are given.

3624. Gateable delay gate generator - Tatarczuk J.R. - Nucl. Sci. Dept., Rensselaer Polytechn. Inst., Troy, N.Y. 12181 - REV.SCIENT.INSTRUMENTS 1972 43/6 (930-931)

An inexpensive delay gate generator is described. The unit can produce delays and pulse widths between 30 nsec and 10 msec, is extremely triggered, and may be gated by a second external input. Four outputs are provided, two of which are complements of the other two and are capable of driving terminated 50 cable. The unit is constructed of standard IC's and a few discrete components.

3625. Decade rate multiplier - Pratapa Reddy V.C.V. and Rajappan K.P. - Ctr. Syst. Devices, Dept. Elec. Engin., Indian Inst. Technol., Madras - PROC.IEEE (N.Y.) 1972 60/6 (759)

In conventional rate mutlipliers, the output pulses are unevenly spaced and therefore are associated with the 'round off error.' The rate multiplier described here gives an output that consists of evenly spaced pulses.

3626. Pulse generator and flip flops - MacFarlane I.P. - Res. Lab., Australian Post Off., Melbourne - IEEE TRANS.INSTRUMENT.MEASUREMENT 1972 IM-21/2 (148-153)

A simple pulse generator can be constructed using IC gates. Such a pulse generator is described and its use to construct edge triggered flip flops is demonstrated. A flip flop for use in a phase comparator is described. Desirable and undesirable characteristics for this application are discussed and examples of R S and J K flip flops given.

3627. A wide range variable frequency phase shift oscillator - Shivaprasad A.P. - Dept. Electr. Communic. Engin., Indian Inst. Sci., Bangalore - IEEE TRANS.INSTRUMENT.MEASUREMENT 1972 IM-21/2 (180-182)

An RC phase shift oscillator, whose frequency of oscillation can be varied from a minimum value to a value as high as desired, thoretically up to infinity, by varying a single resistor in the phase shift network, is described.

3628. An abundance of sinusoidal RC oscillators - Sidorowicz R.S. - Dept. Electr. Engin., Imp. Coll. Sci. Technol., London - PROC.IEE 1972 119/3 (283-293)

It is assumed that a sinusoidal RC oscillator consists of a linear, passive or active RC network and an amplifier. The properties of such an oscillator are primarily dependent on its open loop voltage transfer function. A general form of this function is introduced for RC oscillators of the second order, and expressions for the required maintenance gain and the oscillation frequency are derived. It is shown that there exist four distinct types of 2nd order oscillators. A set of basic building elements for the oscillators is proposed. This consists of some simple RC networks, a voltage divider, a buffer and two amplifiers. The theory and the building elements are used to develop 18 novel oscillator circuits. All these oscillators have either two earthed tuning capacitances or two earthed resistances. It is shown that six of them can be tuned by varying only one capacitance or resistance. Eight of the oscillators are tunable by varying a voltage parameter; in four of these, the voltage tuning range can be very wide. 14 additional 2nd order oscillators are suggested. A general 3rd order RC oscillator is also considered, and it is shown that there exist 15 distinct kinds of this oscillator. The procedure used in the development of the 2nd order oscillators can also be applied to the design of those of the third order. It is thought that this will lead to a very large number of different oscillator circuits.

3629. New method of interference rejection in fast analogue digital convertors - Velasevic D. - Dept. Electron., Boris Kidric Inst. Nucl. Sci., Vinca, Belgrade - PROC.IEE 1972 119/2 (127-132)

A new method of solving the problem of interference rejection in high speed analogue digital (a.d.) convertors is given. The measurement speed obtained in such a way in multichannel data acquisition systems is much higher (up to two orders of magnitude) than that obtained with filters and integrating a.d. convertors which have the same rejection of line frequency. Different solutions of interference rejection, based on the same method, are presented. A time interval of only 20 ms is required to achieve line frequency suppression higher than 50 dB, so that the fast a.d. convertors could replace the integrating ones. The method proposed is especially suitable for application in online computer systems.

3630. Thumbwheel switches set synthesizer output frequency - Foote J.L. - Univ. Utah Coll. Med., Salt Lake City, Ut. - ELECTRONICS 1972 45/12 (100-101)

Two binary coded thumbwheel switches can set the output of a two decade frequency synthesizer that includes the two switches, a single crystal oscillator, and two decade counters. Synthesizer output accuracy and long term frequency stability are the same as that of the crystal used as the reference frequency source. Whatever pulse to pulse time variation occurs is minimized to an acceptable level by a chain of binary counters.

3631. Filament transformer output drops cost of 400 Hz supply - Coers G. - Texas Instrum., Components Group, Dallas, Tex. - ELECTRONICS 1972 45/8 (100)

Power supplies with a 400 hertz output are often needed in testing servo systems and aircraft equipment, but they can be expensive to build when their output voltage must be on the order of 115 volts, root mean square. This being the equivalent of a peak to peak voltage of 325 V, the circuit transistors would have to have very high operating voltage ratings, and since there are no integrated amplifiers that can handle ± 160 V, a discrete amplifier would be required. Alternatively, the number of parts and component costs can both be considerably reduced by generating the 400 Hz sine wave at some low voltage level and then stepping it up with a transformer. This approach allows low cost transistors and integrated circuit operational amplifiers to be used, yet it produces enough output power to operated small motors, servos, resolvers, and synchros. Larger output transistors and a larger transformer will, of course, increase output power.

3632. Height to width converter digitizes analog samples - Turner R.J. - RCA Corp., Missile and Surface Radar Div., Moorestown, N.J. - ELECTRONICS 1972 45/8 (99)

By controlling the charge on a storage capacitor, a temperature stabilized height to width converter can produce a gray code output from an analog input sample. The converter uses a differential diode transistor arrangement to operate over a temperature range of -55°C to +65°C, and its conversion error is less than 0.15 microsecond for a full scale output pulse width of 3.25 μs.

3.6. Telemetric devices

3633. Low level television systems - Dillon J.A. - INSTRUMENTS CONTROL SYST. 1972 45/3 (48-49)

The principles of television systems which can operate at 10^{-5} foot candles are reviewed.

3634. How to get fm quality over am - Editorial - ELECTRONICS 1972 45/12 (6E,8E-9E)

West Germany's Standard Elektrik Lorenz

AG has developed a technique that transmits musical programs, normally occupying a 15-15,000 hertz bandwidth, with fm quality on a-m radio channels of less than half that width. The technique has been implemented in an experimental setup at SEL's Central Applications Lab.

3.7. Data loggers

3635. A versatile pulse programmer for pulsed nuclear magnetic resonance spectroscopy - Tarr C.E. and Nickerson M.A. - Dept. Phys., Univ. Maine, Orono, Me. 04473 - J.PHYSICS E:SCI.INSTRUM. 1972 5/4 (328-331)

A digital pulse programmer producing the standard pulse sequences required for pulsed nuclear magnetic resonance spectroscopy is described. In addition, a 'saturation burst' sequence, useful in the measurement of long relaxation times in solids, is provided. Both positive and negative 4 V trigger pulses are produced that are fully synchronous with a crystal controlled time base, and the pulse programmer may be phase locked with a maximum pulse jitter of 3 ns to the oscillator of a coherent pulse spectrometer. Medium speed TTL integrated circuits are used throughout.

3636. Unclocked logic element makes quick decisions - Torok L.K. - Univ. Toronto - ELECTRONICS 1972 45/8 (98)

A new kind of logic element can make logic decisions without requiring a clock for synchronization. Called Jade, this asynchronous decision element can operate at speeds as high as clocked logic blocks, offers easy debugging, and allows sequential logic systems to be mechanized directly from flow charts. Moreover, Jade will operate in clocked as well as unclocked systems.

3.8. Cameras

3637. An eye mark camera for use in driver behaviour studies - Rutley K.S. - Drivers Aids and Abilities Sect., Road Res. Lab., Dept. Environm., Crowthorne - MED.BIOL.ENGINEERING 1972 10/1 (101-103)

The technique involves superimposing on a cine film of the scene ahead of the driver, a spot of light derived by reflection from the front surface of the eye (the cornea). The centre of curvature of the cornea does not coincide with the centre of rotation of the eye. Consequently a virtual image of a bright lamp filament seen reflected in the cornea will move as the eye moves. With the aid of the fibre optic cables a spot thus formed can be made to appear on the cine film of the scene ahead of the driver. Two separate lenses are used; one to record the scene and one to record the reflection from the eye. The relative magnifications of the lenses are such that when the images from the lenses are superimposed in the manner described below the reflected spot of light moves over the picture of the scene by the correct amount. The constancy of curvature of the cornea and the way the eye moves in its socket set limits on the fidelity with which the true viewpoint is indicated using the method. However, angles of up to ± 10° of horizontal and vertical movement may be covered with the spot faithfully indicating the viewpoint.

3638. The modulation transfer functions of fiber optic devices - Trofimova L.S. and Sattarov D.K. - SOV.J.OPT.TECHNOL. 1971 38/10 (586-587)

The optical transfer coefficients of real fiber optic devices with different inherent apertures, measured at different apertures of the illuminator and receiver, are given.

3639. The effect of a slit type shutter on the modulation transfer function of a camera lens - Mayevskiy G.V. - SOV.J.OPT.TECHNOL. 1971 38/10 (593-594)

It is shown that a slit shutter reduces the optical transfer coefficient of a camera lens because of diffraction. A formula is derived for MTF analysis of a lens slit system.

3640. A storage vidicon electrophotographic spectrum imager for the visible spectrum - Cherkasov Y.A., Kislovskiy I.L., Andronov V.V. et al. - SOV.J.OPT.TECHNOL. 1971 38/10 (604-608)

This paper describes an electrophotographic spectrum imager built around a storage vidicon. The spectrum imager can be used for displaying, examining and recording spectrograms and microphotograms of the visible spectrum in a periodic mode of operation with a frequency of 25 frames/sec and in a time integrating mode with a resolution of 25 mm^{-1} and a sensitivity of 200 GOST units.

3641. Half pentaprism eyepiece subassembly - Filatov V.S. and Mozharov G.A. - SOV.J.OPT.TECHNOL. 1971 38/10 (635-636)

The half pentaprism eyepiece subassembly to be discussed is intended to ensure that the distance between the optical axes of the eyepieces is properly adjusted in terms of the observer's interpupilary distance.

3642. Holographic recording in lithium niobate - Amodei J.J. and Staebler D.L. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (71-93)

This article provides an up to date comprehensive review of the physics and performance properties of undoped $LiNbO_3$ in holographic storage applications. It describes the physical model and shows the quantitative and qualitative agreement between the transport theory developed earlier and the available experimental evdence. Some of the practical aspects of performance are discussed and methods for improving the multiple hologram recording properties of the crystals are explained.

3643. Optical and holographic storage properties of transition metal doped lithium niobate - Phillips W., Amodei J.J. and Staebler D.L. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (94-109)

Measurements of recording sensitivity, maximum diffraction efficiency, and erase behavior have been carried out on $LiNbO_3$

crystals doped with various first row transition elements. Manganese, iron and copper doped crystals have distinctive absorption spectra and show large increases in sensitivity over undoped crystals, a factor of 500 in the case of iron. The erase sensitivity of crystals doped with iron during growth is an order of magnitude lower than the record sensitivity. When iron doping is carried out by diffusion, record and erase behavior become nearly symmetrical.

3644. Thermoplastic media for holographic recording - Credelle T.L. and Spong F.W. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (206-226)

Thermoplastic photoconductor media for holographic recording combine the advantages of high sensitivity and resolution, dry and nearly instantaneous in situ development, erasability, and high readout efficiency. This article reviews the structure, fabrication, and techniques for holographic recording in this medium. Several new results are reported including holographic grating efficiencies of 40%, image reconstruction efficiencies of 35% with little distortion, resolution in excess of 4100 cycles/mm, insensitivity to high ambient light levels during recording, and a post development step to increase the diffraction efficiency of weak holograms.

3645. Recording considerations for RCA holotape - Bartolini R.A., Bordogna J. and Karlsons D. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (170-205)

The differences among Fresnel, Fraunhofer, and lensless Fourier transform holograms are reviewed. Paraxial and nonparaxial analyses are included. Practical arrangements for recording small, thin, relief phase holograms of photographic transparencies of these types are discussed.

3646. Redundant holograms - Firester A.H., Fox E.C., Gayeski T. et al. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (131-153)

This paper reviews progress made in the development of a holographic prerecorded television system and examines the fundamental bases for the elimination of coherent light noise. In particular, it points out that when the system noise is large, there is a maximum redundancy per unit hologram area that can be gainfully employed without introducing coarse structures within the image that are attributable to the redundancy itself.

3647. Photographic cameras, emulsions and processing - Mullins L. - Kodak Ltd., Harrow - J.PHYSICS E: SCI.INSTRUM. 1972 5/4 (297-303)

The major points of progress in the last twenty years or so in photographic cameras, emulsions and processing are discussed in relation to silver halide processes.

3648. New lens seen as atom spy - Editorial - ELECTRONICS 1972 45/12 (9E)

A team of researchers at West Germany's Siemens AG are now working on a new type of electron microscopic lens with the aid of low temperature physics. The team decided to try a coreless system and, in the process, is exploiting the effects of superconductivity.

4. COMPUTERS

4.2. Analog

3649. Epidemiology - Dionne P.J. - Electron. Div., Computers Contr. Dept., Battelle Mem. Inst., Pacific Northwest Lab., Richland, Wash. 99352 - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (126-128)

A simple problem in epidemiology is described. The purpose is to demonstrate how computers, analog in this paper, can be used to assist the student in visualizing a complex system. The very act of creating the necessary equations to describe a system forces the experimenter to crystallize his understanding of the system. When, and usually if, the computer simulation does not match the data, the investigator must revise his model. Several iterations result in a more accurate understanding of the system being studied. The analog computer is a handy tool for performing rapid parameter studies and model revisions at low cost. More scientific investigators need exposure to the advantages of small low cost computers.

3650. Analog memory devices employing PE FE interactions for adaptive control voltage modules - Perlman S.S., McCusker J.H. and Boardman S.M. - RCA Lab., Princeton, N.J. 08540 - IEEE TRANS.SON.ULTRASON. 1972 SU-19/2 (239-245)

Adaptive ferro electric devices utilizing piezoelectric (PE)-ferroelectric (FE) interactions are reviewed. These devices are typically composed of two ceramic FE capacitors mechanically bonded together. When an input voltage is applied to one capacitor, it vibrates due to its PE properties. The vibrations are coupled to the output capacitor where a PE voltage is developed. Because of the PE-FE interaction the PE coefficients of the capacitors depend on their state of FE polarization. Thus the output voltage of the device can be 'set' to different values by the application of a polarizing voltage adapt pulse to either of its capacitors. Electronic control systems requiring analog memory for 'setting' a variable or function to a desired level have generally been limited to ones employing mechanical memory devices. Solid state systems are possible using adaptive devices. One such system is described which supplies a 'settable' control voltage in the range 0 to + 10 Vdc that can be remembered accurately for periods of time measured in years, yet can be changed quickly (milliseconds) or slowly (dekaseconds) merely by applying a polarizing voltage adapt pulse. Positive or negative pulses reduce or increase the control voltage setting, respectively. The system can be used for analog control of electronic functions provided appropriate automatic gain control circuits are employed.

3651. Programmed sweep unit for expanding the capabilities of a CAT - Hall L.H. - Chem. Dept., Univ. California, Berkeley, Calif. 94720 -

REV.SCIENT.INSTRUMENTS 1972 43/3 (561-563)

The versatility of the CAT is expanded by a newly designed programmed sweep unit, which varies the dwell time during the sweep so as to optimize placement of points. System performance with the programmed sweep unit is at least an order of magnitude better than alternative methods such as oscillography.

4.3. Digital

3652. Stability of spatial digital filters - Farmer C. and Bednar J.B. - Univ. Tulsa, Okla. - MATH.BIOSCI. 1972 14/1-2 (113-119)

The paper discusses the extension of the well known stability theorem for digital filters to two dimensions. Several independent proofs of the stability theorem, which were first obtained by Shanks and Justice in the context of Banach algebras and z-transforms, are also discussed.

3653. Statistics of the estimate of coherence - Carter G.C. and Nuttall A.H. - New London Lab., Nav. Underwater Syst. Cent., New London, Conn. 06320 - PROC.IEEE 1972 60/4 (465-466)

Expressions for the moments of the estimate of magnitude squared coherence are presented. The expressions presented are in convenient and accurate forms for digital computer evaluation. Simple approximations are given for the bias and variance.

3654. Cellular array arithmetic unit with multiplication and division - Gardiner A.B. and Hont J. - Dept. Electr. Engin., Paisley Coll. Technol., Paisley, Renf. - PROC.IEE 1972 119/6 (659-660)

A number of papers have been written recently describing cellular array multipliers and dividers. The usefulness of these schemes is in their speed of operation and the simplicity of the array structures. However, the structures are such that multiplication and division require separate arrays and possibly different types of cells. Since the number of cells in an array is proportional to the square of the word length used, it would be a tremendous saving if the multiplier and divider could share a large percentage of the hardware. In this paper, some of the existing multiplier and divider arrays are briefly described, and a new multiplier is developed which has an array structure compatible with one of the dividers. It is then shown how this multiplier/divider can be implemented using Hoffmann cells, requiring considerably fewer cells than two separate units. With the addition of a few more control lines, the array can be operated as a complete arithmetic unit allowing a range of single precision arithmetic and logical operations and double precision arithmetic operations.

3655. An ADC controller and MOS buffer for the laboratory oriented computer - Brandon C.W., Cox Jr J.W., Keller F.W. and Brody D.A. - Div. Clin. Physiol., Univ. Tennessee Med. Units, Memphis, Tenn. 38103 - COMPUTERS BIOMED.RES. 1972 5/3 (291-300)

This work describes a relatively inexpensive device constructed for use on computers without DMA or API that has the effect of freeing considerable amounts of CP time while digitizing large numbers of channels at relatively high sampling rates. The device consists of the logic needed to control the analog to digital conversion, and a MOS shift register buffer to provide temporary storage of from 1 to 64 channels of multiplexed analog input. After all channels have been converted, the computer receives a single interrupt at which time it reads the converted values from the shift register memory into the computer at maximum speed. Although the unit has been constructed especially for the PDP 7 computer, it is described in such a way as to allow its implementation on many different computer systems.

3656. Materials for magneto optic memories - Cohen R.W. and Mezrich R.S. - RCA Labs, Princeton, N.J. RCA REV. 1972 33/1 (54-70)

The authors review the capabilities of magneto optic materials and indicate the possibilities and limitations of their use in data storage and retrieval systems. On the basis of ideal material properties, a lower limit of the required laser power for Curie point writing is obtained, and the material systems in which this lower limit can be approached are discussed. A new figure of merit is proposed which reflects both heat sensitivity and read out requirements. This figure of merit allows the rapid evaluation of the relative qualities of materials for magneto optic memories. It is found that, while system requirements for resolution and read out efficiency can be met with presently available materials, there is a serious discrepancy between the write sensitivity demanded by a holographic system and material capabilities, either present or anticipated. Advances in laser technology are necessary in order to achieve the advantages of a holographic magneto optic memory.

3657. Second order difference integrator. Design base for realising high resolution digital differential analysers - Bywater R.E.H. - Dept. Electron. Electr. Engin., Univ. Surrey, Guildford - PROC.IEE 1972 119/2 (138-142)

The limited information transmitted between integrators in binary and ternary systems has led to consideration of multibit methods. However, conventionally implemented, these are expensive, because each integrator requires not only a more complex interconnection matrix, but also a full multiplier. The use of 2nd order differences leads, in many instances, to a cheaper system, because, in a fast machine, the integral increments will not change significantly between solution steps.

3658. Time domain design of nonrecursive least mean square digital filters - Kellogg W.C. - Coll. Engin., Boston Univ., Boston, Mass. - IEEE TRANS.AUDIO ELECTROACOUST. 1972 AU-20/2 (155-158)

A time domain method is presented for designing nonrecursive digital filters that are optimum in the sense that the output samples are least mean square estimates of the samples of some desired signal. The method requires that one know the input autocorrelation function and the crosscorrelation function between the input and the desired output. Several examples are given of filters designed by the method. The optimum filters can be obtained by sampling the impulse responses of optimum filters for continuous reconstruction of the waveforms from their samples.

3659. High contrast, high sensitivity cathodochromic sodalite for storage and display applications - Faughnan B.W. and Shidlovsky I. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (273-295)

Recent developments in high contrast, thermal erase, cathodochromic materials are presented. The distinction between photochromism and optically reversible and thermally reversible cathodochromism is clarified. The synthesis and sensitization of hydrothermal sodalite is discussed. Experimental results in the form of contrast ratio versus electron beam flux are presented for a wide variety of bromide sodalite powders. Measurements were made in both reflection and transmission modes on both loose powders and thin settled slides. Data is presented on the sensitivity of the materials as a function of material preparation, particle size, method of measurement, and electron beam voltage. With the most sensitive materials, a CR of 10:1 is achieved for a flux less than 15 $\mu C/cm^3$, measured in transmission using a narrow band interference filter at the bromide absorption peak. Under identical conditions a CR in excess of 100:1 is obtained for a flux of several hundred $\mu C/cm^2$. However, the most sensitive materials also show significant room temperature decay after several minutes. The intrinsic absorption coefficient k of a settled solidate screen is measured by optical transmission using an index matching technique; for CR = 10.1, k = 1000 cm^{-1} and for CR = 100:1, k = 4000 cm^{-1}. The effective gain g of a cathodochromic screen is defined by the equation CR = e(gkD), where D is the electron beam penetration depth, and CR is measured in transmission. g is found to be a monotonically decreasing function of CR with g = 5.4, 4.1 and 2.3 for CR = 1:1, 10:1, and 100:1, respectively. The amount by which g exceeds unity represents the enhanced absorption introduced by multiple scattering inside and between the multi layered particle screen.

3660. Erase mode recording characteristics of photochromic CaF_2, $SrTi0_3$, and $CaTi0_3$ crystals - Duncan Jr R.C. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (248-272)

Erase mode optical recording characteristics of photochromic crystal wafers of CaF_2:La,Na; CaF_2:Ce,Na; $SrTiO_3$:Ni,Mo,Al; and $CaTiO_3$:Ni,Mo have been measured. An argon laser operating at 5145Å was used for both optical recording and optical readout. Sensitometric curves of optical density change versus logarithm of exposure are shown for a number of erase beam intensities between 0.2 mW/cm^2 and 2 W/cm^2. In this range, time intensity reciprocity holds for the CaF_2 materials but fails for the titanates, particularly at low intensities. The dependences of sensitivity, gamma, and maximum transmission contrast ratio on wafer thickness and material are discussed. Wafers of $SrTiO_3$, $CaTiO_3$, and CaF2 exhibiting approximately equal maximum contrast ratios have relative sensitivities approximately in the ratio 5:2:1, respectively, at an erase intensity of 1 W/cm^2. In the regime studied, the ratio of gamma to maximum optical density change for each material is found empirically to be independent of wafer thickness.

3661. A bound on limit cycles in fixed point implementations of digital filters - Sandberg I.W. and Kaiser J.F. - Bell Telephone Lab. Inc., Murray Hill, N.J. 07974 - IEEE TRANS.AUDIO ELECTROACOUST. 1972 AU-20/2 (110-112)

An upper bound on the rms value of self sustained limit cycles in fixed point implementations of digital filters is presented. The bound can be easily evaluated for the important special case of sections of order two, and simulation results for this case show that the bound is a useful tool.

5. SPECIFIC MEASUREMENTS

3662. A surface viscosimeter based on oscillations of large amplitude - Bragadin E. - Inst. Phys. Chem., Univ. Florence - REV.SCIENT.INSTRUMENTS 1972 43/3 (468-470)

This paper describes a very large amplitude torsional device for measuring surface viscosity. Its main feature is the possibility of submitting the floating ring to angles of oscillation as great as 270°, thus allowing study of the same film for the entire range of the elastic and the Newtonian viscous state. The design and performance of the viscosimeter is described, and certain possibilities for future investigations are briefly outlined.

3663. Three axis goniometer for EPR sample orientation - Batley M., Bramley R., Merz B.E. and Orr W. - Res. Sch. Chem., Austral. Nat. Univ., Canberra - REV.SCIENT.INSTRUMENTS 1972 43/3 (425-427)

A goniometer is described which is suitable for EPR sample orientation over the temperature range from ambient to the lambda point of liquid helium. It permits 360° rotation of the sample about one axis and total variations of 30° about each of 2 other orthogonal axes.

5.1. Temperature

3664. Radio frequency heating apparatus using a cylindrical cavity resonator - Guinet P. - Lab. Electron. Technol. Informat., CEA CENG, Grenoble Gare - REV.SCIENT.INSTRUMENTS 1972 43/3 (454-457)

A new type of RF furnace is described. It has been studied to heat, to very high temperatures, materials in the intermediate resistivity range (10^6-10 .cm) and thus to obtain fusion without contamination. The furnace is a half wave resonator of the shielded helix type. Power is generated by a commercial HF triode directly coupled to the resonator. Calculations concerning the resonant conditions are proposed, and results obtained with a furnace 20 kW HF power are given. Hot refractory oxides are replaced by tap water for reliable measurements. Ti_2O_3, Al_2O_3, and Y_2O_3 melting points have been reached. However, it has not been possible to obtain the conditions required for aself crucible type of fusion to be obtained.

3665. How to keep the temperature of a hot wire constant - Ouwens C.D. and Koken J. - Univ. Technol., Eindhoven - REV.SCIENT.INSTRUMENTS 1972 43/3 (451-453)

A method is described of stabilizing the temperature of a heated wire under changing conditions of cooling and evaporation. It depends on controlling the resistance of the wire by the use of a power supply having a special current voltage characteristic. The characteristic has been obtained by a slight change in a normal commercial apparatus. The great advantage of the control is its simplicity. Application of a thermocouple or optical measurement of the temperature of the heated wire is not necessary. Measurements on a tungsten wire at 1100°C showed the temperature to change less than 10°C in spite of a 800% variation in the energy input. Working at constant voltage causes the temperature to change more than 200°C by this input variation. The method can be applied to electrical furnaces, degassing of metals, electromotors, hot filament ionization of gases, etc. Variations in cooling rate require a different voltage current characteristic of the power source than does evaporation or aging of the wire.

3666. Multisample cold finger for a dilution refrigerator - Gubser D.U. and Jones L.D. - US Nav. Res. Lab., Washington, D.C. 20390 - REV.SCIENT.INSTRUMENTS 1972 43/6 (943-945)

A sample holder that allows several samples to be simultaneously placed within the $^3He/^4He$ fluid of a dilution refrigerator is described. Samples are located inside a long narrow cold finger through which the cryogenic fluid is continuously circulating. Entry for installing samples is made with a removable soft solder seal. Magnetic effects of this soft solder seal are reduced by locating the seal near the top of the cold finger while samples are located near the bottom. The degree of isothermal conditions maintained along the length of the cold finger is examined, and operational characteristics of a sample holder presently being used are discussed.

3667. An all glass liquid helium Dewar employing no auxiliary cryogens - Wheatley J.C. and Strait S.F. - Dept. Phys., Univ. California, San Diego, La Jolla, Calif. 92037 - REV.SCIENT.INSTRUMENTS 1972 43/6 (859-864)

A new type of all glass silvered Dewar for liquid helium is described in which no auxiliary shielding cryogens are required. Radiation shielding is effected by means of an auxiliary annular space around the helium vessel which is kept cold by its own heat capacity and by the process of natural convection utilizing the refrigeration in the rising helium vapors. A test Dewar with maximum helium volume of 860 cm^3 held helium at atmospheric pressure for over 40 h and at pressures below 2 mm Hg for over 28 h.

3668. Hydraulically actuated valve for very low temperatures - Roach P.R., Ketterson J.B. and Kuchnir M. - Argonne Nat. Lab., Argonne, Ill. 60439 - REV.SCIENT.INSTRUMENTS 1972 43/6 (898-899)

In order to seal off an experimental cell containing liquid He at temperatures down to 20 mK and at pressures up to 25 atm the authors have developed a valve that is actuated hydraulically by liquid He and which seals repeatedly with a leak rate of less than 10^{-10} cm^3/sec of liquid He II.

3669. Two improved simple instruments for measuring low frost points - Dickson M.R. - Electr. Res. Ass., Leatherhead - J.PHYSICS E:SCI.INSTRUM. 1972 5/4 (379-383)

Two inexpensive cooled mirror instruments have been designed for the determination of dew points and frost points down to -50°C or lower with an accuracy of approximately ± 1°C at that order of frost point. Measurement errors and effects of operator technique have been made small, firstly by a combination of design features, and secondly by a modified method of interpreting the temperature readings. In addition, in one of the two instruments described observational difficulties have been minimized by a design that results in one localized cold spot of accurately measured temperature on an otherwise apparently unbroken mirror surface; this latter instrument is particularly suitable for site use and by inexperienced personnel.

3670. A direct access ^3He cryostat - Jericho M.H., Simpson A.M. and Singh O. - Phys. Dept., Dalhousie Univ., Halifax - J.PHYSICS E:SCI.INSTRUM. 1972 5/4 (326-327)

Details of the design and construction of a ^3He cryostat are described in which the experimental sample may be removed and replaced without warming the bulk of the cryostat above 4.2 K.

5.4. Pressure

3671. Toroidal memory core as an inexpensive pressure sensor - SPEICHER RINGKERN ALS BILLIGER DRUCKAUFNEHMER - Wahl G. - ELEKTRONIK 1971 20/10 (358)

A description is given of a simple pressure or strength measuring device in which a toroidal memory core is used as a recorder. The effect of mechanical forces on the magnetic properties of siferrite material is well known. Thus, construction of a relatively cheap electronic pressure sensor is now possible.

3672. A solid electrolyte oxygen gauge for monitoring trace quantities of water vapor in hydrogen gas - Klinedinst K.A. and Stevenson D.A. - Dept. Materials Sci. Engin., Stanford Univ., Stanford, Calif. 94305 - REV.SCIENT.INSTRUMENTS 1972 43/3 (417-419)

An oxygen gauge, capable of measuring water content in hydrogen gas as low as a few parts per billion, is described. The gauge consists of a solid state electrochemical concentration cell employing yttria doped thoria as an electrolyte.

The performance of the gauge at 4 operating temperatures between 600 and 900°C is evaluated.

3673. Differential micromanometer - Gill S.J. and Dresden C. - Dept. Chem., Univ. Colorado, Boulder, Colo. 80302 - REV.SCIENT.INSTRUMENTS 1972 43/3 (551-552)

A highly sensitive differential manometer is described. A unique feature of this manometer is its immunity to tilting. This feature is realized by a design which uses concentrically located regions of large fluid surface area which are connected to each other by means of a small capillary. Slight changes (1μ H_2O of pressure can be detected by bubble movement in the capillary.

5.5. Flow

3674. Simple helium flowmeter for dilution refrigerators - Niinikoski T.O. - CERN, Geneva - REV.SCIENT.INSTRUMENTS 1972 43/3 (430-433)

This flowmeter measures the molar flow rate of ^{3}He and ^{4}He gas, independently of pressure or isotopic composition. The principle is based on the constant C(p). A calibration is needed for high accuracy.

3675. Note on the falling cylindrical shell viscometer - Lindgren E.R. - Dept. Engin. Sci. Mech., Univ. Florida, Gainesville, Fla. 32601 - REV.SCIENT.INSTRUMENTS 1972 43/3 (557-559)

A simple theory is presented according to which forces appear which tend to center the cylindrical shell in the fall tube of a falling cylindrical shell viscometer. This same result essentially should be obtained also for the falling cylinder viscometer, which necessarily must obey the same general principles but is more complicated in the analytical manipulations.

3676. An automatic Zimm Crothers type viscometer - Stork W.H.J. and De Vroome H. - Med. Biol. Lab., TNO, Rijswijk - J.PHYSICS E: SCI.INSTRUM. 1972 5/4 (314-316)

An automatic Zimm Crothers type viscometer is described which permits very accurate measurements at various values of the shear stress, using only one rotor.

5.10. Displacement

3677. A new digital instrument for measuring angular velocity and acceleration - Szabados B., Sinha N.K. and DiCenzo C.D. - Dept. Electr. Engin., McMaster Univ., Hamilton, Ont. - PROC.IEEE 1972 60/4 (455-456)

A new approach to the digital measurement of angular velocity and acceleration is discussed. The proposed instruments provide a very high precision and resolution in measurement. The measurements can be made in a very short time, which may be regarded as almost instantaneous for many practical applications.

5.11. Electric phenomenons

3678. Current voltage curves of porous membranes in the presence of pore blocking ions. I. Narrow pores containing no more than one moving ion - Heckmann K., Lindemann B. and Schnakenberg J. - II Dept. Physiol., Univ. Saarland, Homburg Saar - BIOPHYS.J. 1972 12/6 (683-702)

A physical model for voltage dependent conductance changes of excitable cell membranes is proposed. It is based on competition of uni and bivalent ions for chains of stable sites extending through the membrane. These one dimensional pathways (pores) have different profiles of chemical potential for the 2 ionic species so that bivalent ions can block the passage of univalent ions at large membrane potentials. The special case is treated so that each pore is either empty or, because of electrostatic repulsion, contains no more than 1 uni or bivalent ion at a time. A system of linear differential equations describes the time dependent probabilities of the various possible pore states. The states are limited by transition rate constants involving the profile of the chemical potential, the membrane voltage, the ionic concentrations in the adjacent baths, and electrostatic interactions between the ions. The steady state solutions (Kirchhoff-Hill theorem) yield expressions for the relationship between the small signal conductance of univalent ions and the concentration of these ions in the external bathing medium (a saturation curve) and for the ionic currents and the steady state current voltage curve (N shaped). From the latter curve we compute the shift of Threshold potential caused by concentration changes of the external bathing medium. The model yields a number of predictions which can be tested experimentally.

3679. Electrostatic bridge circuit for simultaneous measurement of charges captured by the plates of an electrostatic precipitator - Iribarne J.V. and Klemes M. - Dept. Phys., Univ. Toronto - REV.SCIENT.INSTRUMENTS 1972 43/3 (391-393)

The problem of measuring simultaneously the positive and the negative charges arriving at the 2 plates of an electrostatic precipitator, as well as their net difference, has been considered. An electrostatic bridge is described that can be applied to determine the net charge using one electrometer, or both charges simultaneously, using 2 electrometers. It is based on distributing the charges acquired by both plates of an insulated precipitator with 2 capacitors in opposition. An electrometer measures the unbalance produced in these capacitors, and a second electrometer may provide a simultaneous measurement on another capacitance. The bridge is particularly suitable to determine small net differences between larger positive and negative charges.

3680. Apparatus for measurement of the dynamic current voltage characteristics of membranes - Huebner J.S. and Bruner L.J. - Biophys. Dept., Michigan State Univ., East Lansing, Mich. 48823 - J.PHYSICS E: SCI.INSTRUM. 1972 5/4 (310-312)

A variable limit linear sweep generator and an electrometer voltmeter with differential input are employed for measurement of the dynamic current voltage characteristics of membranes.

5.14. Radiation

3681. A time of flight chemical accelerator for low center of mass energy spreads - Leffert C.B., Jackson W.M., Rothe E.W. and Fenstermaker R.W. - Res. Inst. Engin. Scis, Wayne State Univ., Detroit, Mich. 48202 - REV.SCIENT.INSTRUMENTS 1972 43/6 (917-925)

An apparatus to obtain high resolution of relative kinetic energy for collision experiments in the electron volt range is described. Because it is the center of mass system that is important in the interpretation of experiments, energy spreads in both the projectiles and the targets are considered. High resolution is achieved in a primary beam with a time of flight technique. The target particles are in the form of a crossed beam. Basically, the scheme consists of observing only those reaction products that are formed in a short range of primary beam flight times. This means that good resolution may be obtained in spite of any inherent energy spread in the beam. The measured quantity is modeled mathematically to show the effect of the energy spreads that remain. These calculations may be used to arrive at the true velocity dependence of the center of mass cross sections.

5.14.1. Visible light

3682. An analysis of the internal noise in opto electronic devices employing wheel type modulators - Ostanin V.I. - SOV.J.OPT.TECHNOL. 1971 38/8 (455-457)

A theoretical analysis of the internal noise originating in a cooled photodetector of an optoelectronic device employing a wheel type modulator is given. Three typical detector designs, with different modulator locations, are considered.

3683. Dynamics of servo systems of double beam photometers - Zabezhinskiy A.D. - SOV.J.OPT.TECHNOL. 1971 38/8 (472-474)

This paper discussed the special aspects of analyzing the dynamics of the servo systems of double beam, compensation type photometers. Methods are suggested for analyzing two of the most widely used types of nonlinear systems of this type at small deviations.

3684. Measurement of contrast transfer coefficients of fiber optic bundles - Trofimova L.S., Sattarov D.K. and Konayeva G.Y. - SOV.J.OPT.TECHNOL. 1971 38/8 (497-500)

A method of measuring contrast transfer coefficients of fiber optic bundles is discussed. The applicability of a test pattern with a square distribution of transmittance is confirmed experimentally.

3685. Sensitive instrument for the study of circular polarization of luminescence - Steinberg I.Z. and Gafni A. - Chem. Phys. Dept., Weizmann Inst. Sci., Rehovot - REV.SCIENT.INSTRUMENTS 1972 43/3 (409-413)

A sensitive instrument is described for the measurement of the extent of circular polarization of light emitted by chiral molecules. In this instrument the intensity of the circularly polarized component of the luminescence light is selectively modulated by an electro optic or photoelastic light modulator, while the unpolarized component of the luminescence is unaffected. The modulated light beam is detected by a photomultiplier and the ac component of the electric signal produced is amplified by a phase sensitive amplifier tuned to the modulation frequency. The light used for the excitation of the sample and the luminescence light are monochromated. An accessory is described which produces controlled mixtures of unpolarized and circularly polarized light and thus permits calibration of the output of the instrument in terms of the degree of circular polarization of the light under examination. Signal to noise ratios of 20 have been readily obtained with luminescence which is circularly polarized to an extent of 10^{-3} to 10^{-4}.

3686. An apparatus for measuring quantum efficiency in electroluminescent devices over a wide current range - Ralston J.M. - Bell Telephone Labs, Inc., Murray Hill, N.J. 07974 - REV.SCIENT.INSTRUMENTS 1972 43/6 (876-878)

An apparatus is described which measures quantum efficiency (or power or luminescent efficiency) in electroluminescent devices. The device test current is pulsed and may be varied over a 100-1 dynamic range. Efficiency measurements are self normalizing and direct reading at any test current. Heating effects are minimized by maintaining a low (1 mA) time averaged LED current. Luminescence is detected using a highly efficient, small volume optical cavity which permits measurements of quantum efficiencies as low as 0.0001% (10^{-6}).

3687. A simple multiple spark system - Wiebelt J.A. and Williamson R.D. - Mech. Engin. Dept., Oklahoma State Univ., Stillwater, Okla. 74074 - REV.SCIENT.INSTRUMENTS 1972 43/6 (899-901)

A simple multiple spark system is described. This spark system was used to provide two spark discharge light sources for use with Schlieren photography. The spark durations were such that shock waves with velocities up to 520 m/sec could be satisfactorily photographed.

3688. The manufacture of large plastic mirrors by the replica method - Beynarovich L.N., Salimova E.A. and Martynov V.P. - SOV.J.OPT.TECHNOL. 1971 38/10 (615-617)

The manufacture of 700 mm diameter spherical mirrors from polyester resins, using Silumin as the base, is described. The cost of these mirrors is about 10% of that of similar mirrors made of glass.

3689. Some characteristics of a pulsed xenon lamp for use as a light source in kinetic spectrophotometry - Hodgson B.W. and Keene J.P. - Paterson Lab., Christie Hosp., Manchester -

REV.SCIENT.INSTRUMENTS 1972 43/3 (493-496)

This paper presents details of the electrical and optical characteristics of Osram XBO 250, 14 V, 18 A, high pressure xenon arc lamps during 1 msec current pulses of several hundred amperes which are used as analyzing light sources in kinetic spectrophotometry. The lamps are operated continuously at their normal rating between pulses and the arc provides a path of high electrical conductivity for the pulse current. As a result the volume occupied by the discharge and the potential drop between the electrodes do not change very much during a pulse, whereas the radiance of the discharge increases by a large factor which depends on current and wavelength. At 450 A the increase in radiance is about 700x in the far ultraviolet, about 300x in the visible, and about 50x in the infrared. XBO 250 lamps operated in this way can withstand many thousands of pulses without excessive deterioration. A circuit for producing the current pulses is described.

3690. Power loss on optical fibers - Snyder A.W. - Dept. Appl. Math., Inst. Advan. Stud., Australian Nat. Univ., Canberra - PROC.IEEE (N.Y.) 1972 60/6 (757-758)

The power loss, due to material absorption from an HE_{11} mode propagating on an optical fiber, is derived and approximations are introduced which simplify its calculation. The attenuation constant of the HE_{11} mode, for fibers with a small index of refraction difference between the core and the cladding, is shown to be equal to the known (measured) loss of the material in bulk multiplied by the fraction of modal power flowing through the lossy region.

3691. Fast coaxial flashlamp pumped liquid dye laser for photolysis - Bunkenburg J. - Johnson Res. Found., Dept. Biophys. Phys. Biochem., Univ. Pennsylvania, Philadelphia, Pa. 19104 - REV.SCIENT.INSTRUMENTS 1972 43/3 (497-499)

This paper describes a fast risetime flashlamp pumped liquid dye laser employing a coaxial lamp, coaxial capacitor, and maintaining a coaxial configuration throughout the system.

3692. $LiNbO_3$ light modulator - Ninomiya Y. and Motoki T. - Tech. Res. Labs, NHK, Tokyo - REV.SCIENT.INSTRUMENTS 1972 43/3 (519-524)

Up to this time, $LiNbO_3$ has not been considered to be a desirable material for a light modulator because of its susceptibility to 'optical damage.' The authors ascertained that the $LiNbO_3$ light modulator could be constructed practically without optical damage when the crystal was heated to 170-180°C. A pair of polished $LiNbO_3$ single crystals were soldered on a piezoelectric resonance damper of copper with pure tin, and were encapsulated in a glass vacuum vessel which prevented turbulence by heated air. It was demonstrated that the performance of the modulator was fine, especially with regard to extinction ratio, temperature characteristics, frequency response, and so on. The optical damage free $LiNbO_3$ modulator is described generally, from the growth condition of a high optical quality crystal to the construction and the performances of the modulator.

3693. Polarization reflection type light modulator using ferro electrics - Hasegawa T. and Sato H. - Def. Acad., Hashirimizu Yokosuka - IEEE TRANS.SON.ULTRASON. 1972 SU-19/2 (183-190)

A polarization reflection type of light modulator is proposed to utilize the deviation of reflectance of polarized light incident on an electro optical medium at an angle greater than the Brewster angle. Feasibility of this method is theoretically investigated for the cases of real as well as complex refractive index. From numerical calculations it is shown that the intensity of light changes linearly with applied voltage under a certain condition, and that this method is applicable to such ferroelectric materials as $BaTiO_3$, SBN and other crystals. The modulation of He Ne laser or Ar^+ laser is demonstrated experimentally at radio frequencies using a $BaTiO_3$ crystal. The merits of this type of light modulator are discussed and compared with crossed polarizer type of light modulator.

3694. A self scanned ferroelectric image sensor - Schlosser P.A. and Glower D.D. - Nucl. Engin. Sect., Dept. Mech. Engin., Ohio State Univ., Columbus, Ohio 43210 - IEEE TRANS.SON.ULTRASON. 1972 SU-19/2 (257-262)

A prototype imaging system consisting of a monolithic sensor array of pyroelectric elements has been constructed which is capable of imaging visible, infrared and x-radiation. The image sensor is a true flat panel, self scanned device which generates a video picture of radiation intensity patterns at the usual television rate of 30 frames per second. The detector material is ceramic lead zirconate titanate which has an individual spot responsivity of 1 V/W. The video information is extracted from the sensor mosaic by digital scanning and video coupling circuits which are connected to the array by row and column address electrodes. The electronic circuitry consists of low cost, low power integrated circuits. The initial prototype system incorporates a 5 x 5 element sensor matrix and a large scale device composed of an array of 2500 spots is currently under construction.

3695. Liquid crystals for electro optical application - Castellano J.A. - RCA Labs, Princeton, N.J. - RCA REV. 1972 33/1 (296-310)

A review of recent studies in the synthesis and physical chemistry of mesomorphic (liquid crystal) materials is presented. The materials parameters that affect both the mesomorphic and electro optical behavior of the compounds are discussed. Compounds that possess a resultant dipole moment oblique to the long axis of the molecule exhibit flow alignment or dynamic scattering, while those compounds that have a dipole moment along the molecular axis can be used to align various guest molecules.

5.14.3. Infrared

3696. The efficiency of infrared spectrometers with monochromators - Nikitin V.A. - SOV.J.OPT.TECHNOL. 1971 38/8 (463-466)

The special problems involved in matching a monochromator with a detector in a wide band IR spectrometer are discussed and an efficiency factor for a given instrument, in terms of its selectivity, signal-to-noise ratio and response speed, is derived. A convenient, practical graphical representation of the operating range of a spectrometer is suggested.

3697. Demountable gallery infrared cell for soft semisolids - Tovrog T. and Krawetz A.A. - Phoenix Chem. Lab. Inc., Chicago, Ill. 60647 - REV.SCIENT.INSTRUMENTS 1972 43/3 (564-566)

A demountable infrared cell with a galley cut in the rear salt window permits the spectral analysis of semisolids with good reproducibility and accurate control of sample film thickness and uniformity. Window breakage, which can be a problem when semisolids are used in standard infrared cells, is essentially eliminated.

5.14.4. Radiowaves

3698. Radiation monitor measures wide band - ELECTRONICS 1972 45/9 (41-42)

A virtually isotropic instrument with a passband that extends from 300 megahertz to 18 gigahertz is announced. An array of thin film thermocouples is used as both the antenna and detector in the new radiation monitor.

3699. A modification of the varian HR-60 NMR spectrometer probe for operation at very low temperatures - Jensen F.R., Smith L.A., Bushweller C.H. and Beck B.H. - Dept. Chem., Univ. California, Berkeley, Calif. 94720 - REV.SCIENT.INSTRUMENTS 1972 43/6 (894-897)

An insert design and probe modification is given which makes it possible to obtain spectra with good spinning and resolution as conveniently at -170°, or below, as can be obtained at 0°. Because of the placement of the pickup coil, the resolution and sensitivity are superior to commercial inserts. At -170° the temperature variation through the sample region is no more than ± 0.01°.

3700. Modification of the Varian XL 100 NMR spectrometer for Fourier transform operation - Sternlicht H. and Zuckerman D.M. - Bell Telephone Labs, Inc., Murray Hill, N.J. 07974 - REV.SCIENT.INSTRUMENTS 1972 43/3 (525-529)

A procedure is described for converting the Varian XL 100 NMR spectrometer from continuous wave to Fourier transform operation. The modification is relatively simple, permitting the use of many different kinds of computer systems and pulse amplifiers. Selection of either the continuous wave or Fourier transform mode is straightforward in the modified spectrometer.

5.14.5. Roentgen radiation

3701. A sealed titanium window proportional counter for the detection of 1/2 keV X rays - McClintock J.E., Levine A. and Rappaport S. - Dept. Phys., MIT, Cambridge, Mass. 02139 - REV.SCIENT.INSTRUMENTS 1972 43/6 (902-905)

A sealed Ti window proportional counter sensitive to x radiation in the energy range 0.35-0.45 keV and > 1.5 keV is described. Measurements of the Ti mass absorption coefficients and a graphical summary of the literature values are presented. For a proportional counter with a 930 $\mu g/cm^2$ (2.1 μ) Ti window, the peak efficiency at 0.45 keV is found to lie between 4.6% and 7.1%. An application in x ray astronomy involving a rocket observation of Sco X 1 is discussed.

3702. A portable calorimeter for X ray measurements of fluence and front surface dose simultaneously - Wood D.S. - Phys. Internat. Co., San Leandro, Calif. 94577 - REV.SCIENT.INSTRUMENTS 1972 43/6 (908-910)

A small, easily portable and highly sensitive x ray calorimeter has been constructed to measure fluence and front surface dose in tantalum from pulsed electron accelerations. Exceptional temperature stability and hence sensitivity is achieved by mounting the absorbers in an isothermal cavity cooled by an ice reservoir. Calibration of the x ray fluence absorber was made by direct exposure to a 400 Ci ^{137}Cs γ ray source.

5.14.6. α, β and γ radiation

3703. Optical photon production in anthracene by electrons with energies between 2 and 10,000 eV - Fisher T.R. and Kohler D. - Lockheed Palo Alto Res. Lab., Palo Alto, Calif. 94304 - REV.SCIENT.INSTRUMENTS 1972 43/3 (471-475)

The response of an anthracene scintillation detector to electrons with energies from 2 to 10,000 eV is reported. The detector response, instead of falling rapidly to zero at energies less than 1000 eV, approaches a constant value of 0.56 photon/incident electron at low energies. The response of the detector in this very low energy region apparently results from a new photon production mechanism which is not understood at present. Above 1000 eV, significantly better spectra are obtained than have been reported previously.

3704. Design and evaluation of a scanning bed whole body counter for use in clinical studies - Watts J.R., Erickson J.J., Kramer C.E. et al. - Vanderbilt Univ. Sch. Med., Nashville, Tenn. 37203 - HLTH PHYS. 1972 23/1 (63-66)

The Vanderbilt University whole body counter was redesigned in order to improve its versatility and to provide for a spatially independent detection efficiency. A scanning bed geometry was used. The new system is capable of determining absolute amounts of radioactivity in selected regions of the body. It is being used to determine organ distribution of radiotracers as well as whole body counting of lower levels of radioactivity.

3705. A motorized drive for the double tilting specimen holder of an electron microscope -

Kritzinger S., Marais D.J. and Monaci T. - Merensky Inst. Phys., Univ. Stellenbosch - REV.SCIENT.INSTRUMENTS 1972 43/6 (866-871)

A detailed description is given of a very compact motorized drive for the double tilting specimen stage of an electron microscope. Tilting is effected by foot controls at a speed which is continuously variable between wide limits. A warning system indicates when it is safe to lift the specimen cartridge from the stage table and a friction clutch protects the delicate tilting stage against possible hazards. Manual tilting is possible by simply turning a lever to disconnect the motorized drive. No alterations to the microscope column are necessary to receive the motorized unit.

3706. Pulse compression techniques in nuclear medicine - Barrett H.H. - Raytheon Res. Div., Waltham, Mass. 02154 - PROC.IEEE (N.Y.) 1972 60/6 (723-724)

A high efficiency 'chirped' linear array of pinholes for imaging a distribution of radioisotopes is described. The image is obtained in a coded or scrambled form, and then decoded using a dispersive surface acoustic wave delay line. Results of an optical stimulation experiment are presented.

5.14.9. Sound

3707. Extensional wave propagation characteristics in striated muscle - Truong X.T. - Physiometrics Res. Lab., VA Hosp., Houston, Tex. 77031 - ACOUST.SOC.AMER. 1972 51/4(II) (1352-1356)

The real part of the complex dynamic modulus for frequencies 50-10,000 Hz was derived from viscoelastic wave propagation constants in whole frog skeletal muscle, in order to provide a material function characteristic of the dynamic longitudinal viscoelastic behavior of resting skeletal muscle in the higher frequency range. The method of measuring the phase velocity and attenuation coefficient of longitudinal waves propagated along the longitudinal axis of thin muscles is described. The results showed that there were significant viscoelastic effects between 50 and 5000 Hz with some levelling off above 5000 Hz, as indicated by the frequency dependence of the wave propagation constants. The relaxation time spectrum derived from the dynamic modulus frequency function showed that about half of the relaxation times were less than 1 msec. The results were generally consistent with other studies based on the time course of stress relaxation and on the relationship between sinusoidal stress and strain.

3708. Attenuation of sound in suspensions and emulsions. Theory and experiments - Allegra J.R. and Hawley S.A. - Jefferson Phys. Lab., Harvard Univ., Cambridge, Mass. 02138 - J.ACOUST.SOC.AMER. 1972 51/5II (1545-1564)

The absorption of sound in emulsions and suspensions is due to viscous and thermal transport processes occurring at the interface of the nonhomogeneities, as well as to the intrinsic absorption in the materials comprising the system. A complete description of these processes for systems of fluid particles suspended in fluid media was given by Epstein and Carhart. However, subsequent investigators of liquid systems have generally neglected the thermal transport process. It is shown that the Epstein Carhart results provide a good description of our experimental attenuation data in emulsions, and that the thermal transport process can be the major factor in the attenuation. The theory is further extended to include the attenuation in suspensions of solid particles, and good agreement is found between the authors' theory and experimental results for aqueous suspensions of polystyrene spheres.

3709. Atmospheric absorption of sound. Theoretical predictions - Evans L.B., Bass H.E. and Sutherland L.C. - Wyle Lab., Huntsville, Ala. 35807 - J.ACOUST.SOC.AMER. 1972 51/5II (1565-1575)

By assuming that air is composed of four gases (i.e., nitrogen, oxygen, water vapor, and carbon dioxide) and applying energy transfer rates for the binary collisions inherent in such a system, absorption of sound in the atmosphere has been predicted. The calculated curves based upon 24 energy transfer mechanisms are compared with experimental data over the humidity range of 0 - 100% relative humidity. Agreement between theory and experiment is very good. By including classical absorption and rotational relaxation effects, the total atmospheric absorption is also predicted at 20 degrees C. Calculations made for various concentrations of CO_2 indicate that low CO_2 levels (less than 0.1%) do not significantly affect absorption of audible sound at high humidities. At very low humidities, however, CO_2 is an important factor.

3710. Wide range calibration system for pressure gradient hydrophones - Bauer B.B., Abbagnaro L.A. and Schumann J. - CBS Lab., Stamford, Conn. 06905 - J.ACOUST.SOC.AMER. 1972 51/5II (1717-1724)

A gradient hydrophone calibrator consists of a precisely made water-filled tank, with ports to receive the hydrophones to be calibrated and the reference pressure hydrophones, which is set into axial oscillation with suitable drivers to develop a standing wave of sound in the water. An improved calibrator is described, which, by using a very rigid tank, covers a range of 3-2500 Hz. Measurements are simplified through use of electrical feedback, which maintains a constant pressure gradient versus frequency function. The applications and limitations of this system to the measurement of sensitivity, frequency response, and phase response of pressure gradient and pressure hydrophones, and for obtaining the polar patterns of gradient hydrophones, are described.

3711. Improved earphone enclosure for communication in noise - Bauer B.B. and DiMattia A.L. - CBS Labs, Stamford, Conn. 06905 - J.ACOUST.SOC.AMER. 1972 51/5 (I) (1388-1393)

Earphone enclosures are described which embody an improved acoustical network for enhanced noise reduction and efficient performance for an earphone. The network uses two chambers, one adjacent to the ear and the other contained in a reentrant expanded portion of the enclosure. The two chambers are connected by parallel passages, one defining predominantly a resistance and the other an inertance. It is shown that this form of network is more effective than an arrangement of inertance and resistance in series. Cushions filled with nonfluid gel provide high wall impedance for improved noise attenuation and conformance with circumaural contours of the head. Values of noise attenuation are given, measured by artificial head and psychoacoustic methods. Performance of a typical earphone in the enclosure is shown.

3712. Precision measurement of the low frequency velocity of sound in helium under standard conditions by a resonance tube method - McIntyre R.G., Barnes T.G. and Chew E.W. - Univ. Texas, El Paso, Tex. 79968 - J.ACOUST.SOC.AMER. 1972 51/5 (I) (1394-1399)

The velocity of sound in helium was measured to be 972.49

3713. Sources of noise in axial flow fans - Mugridge B.D. and Morfey C.L. - Inst. Sound Vibrat. Res., Univ. Southampton - J.ACOUST.SOC.AMER. 1972 51/5 (I) (1411-1426)

Experiments and theory relating to fan noise sources are reviewed with emphasis on axial flow machines. At supersonic rotor speeds, the steady shock pattern attached to a rotor is an efficient radiator of sound. In most practical cases of subsonic rotor operation, however, direct radiation from the rotor-locked pressure field is negligible compared with the indirect radiation, or scattering, caused by circumferential distortions in the steady flow field surrounding the rotor. Random timewise modulation of the distortion changes the scattered spectrum from discrete to continuous with a gradual progression from narrow-band tones to broad-band noise as the modulation bandwidth is increased. Similar scattering occurs when a nonuniform unsteady flow impinges on stator vanes, but here the radiated frequency is that of the impinging flow. Finally, for blades operating in flows free from circumferential distortions, self generated turbulence becomes an important source of noise. The paper describes the physical mechanisms involved in each of these processes, including the generation of unsteady lift by turbulence. Order of magnitude sound power estimates are compared where possible with experiment.

3714. Research on fan noise generation - Benzakein M.J. - Gen. Electr. Co., Cincinnati, Ohio 45215 - J.ACOUST.SOC.AMER. 1972 51/5 (I) (1427-1438)

Different aspects of multiple pure tone (MPT) 'broadband' noise generation in high speed fans are discussed. An analytical model for multiple pure tone generation is presented. Experimental evidence indicates that the MPT generation does not seem to be a function of the presence of shock waves. It is also shown that fan 'broadband' noise is not broadband in character and could be attributed to the modulation of the blade passing frequency tones, their sub and higher harmonics.

3715. A device for producing two serial tone bursts of different loudness - Whittingham T.A. - Univ. Aberdeen - PERCEPT.MOTOR SKILLS 1972 34/2 (527-530)

A device is described which presents 2 serial tone bursts to S. The duration of the tone bursts, the interval between tone bursts, and the intensity of the second relative to the first, may be changed at will by the operator. The device is capable of extension to allow other parameters, such as frequency or waveform, to be altered between tone bursts. The instrument is being used in a project to assess the effects of drugs on the latency of recovery from auditory stimulation.

3716. Ultrasonic A scan to B scan conversion by an optical fibre device - McDicken W.N. - Dept. Clin. Phys. Bio Engin., West. Reg. Hosp. Board, Glasgow - ULTRASONICS 1972 10/3 (134-137)

A system is described which can convert an A scan ultrasonic unit into a compound B scanner. In this system a flexible array of optical fibres and a mechanical arrangement take the place of the position locating electronics and mechanical gantry of a conventional compound B scan unit. A prototype device has been made and details of its construction and performance are given. The device offers a simple and inexpensive method of producing a compound B scan machine from an A scan instrument.

3717. Detection of underwater sound sources by microwaves radiation reflected from the water surface - Tremain D.E. and Angelakos D.J. - Dept. Elec. Eng. Comput. Sci., Electron. Res. Lab., Univ. California, Berkeley, Calif. 94720 - PROC.IEEE (N.Y.) 1972 60/6 (741-742)

Experiments were conducted to investigate the feasibility of detecting low frequency underwater sound sources under turbulent surface conditions by illuminating a portion of the surface with microwave radiation.

3718. High sensitivity underwater acoustic velocimeter - Holbrook G.W. and Srinivasan N. - Nova Scotia Techn. Coll., Halifax - IEEE TRANS.INSTRUMENT.MEASUREMENT 1972 IM-21/2 (124-127)

The analysis and design of an underwater acoustic velocimeter employing a high frequency CW resonance technique is presented. It is shown that such an instrument achieves high sensitivity and resolution and is believed to be relatively immune to the effects of turbulence. The analysis is illustrated by a prototype design giving a sensitivity of 84 Hz/ft/s of sound velocity.

3719. Measurement of the directivity characteristics of loudspeakers and microphones in a reverberant enclosure - Capetanopoulos C.D. - Dept. Elec. Engin., Manhattan Coll., Bronx, N.Y. 10471 - IEEE TRANS.AUDIO ELECTROACOUST. 1972 AU-20/2 (151-154)

Continuous automatic recordings of the directivity patterns at various frequencies have been obtained for loudspeakers and microphones placed in a reverberant enclosure. Tone bursts and electronic gating have been used to simulate free field conditions. This method appears to give results as accurate as those obtained in an anechoic chamber. The lowest measurement frequency of the directivity pattern is determined by the size of the enclosure available.

3720. Mean and fluctuating velocity contours and acoustic characteristics of subsonic and supersonic jets - Nagamatsu H.T. - AIAA PAPER 1972 January (72-157)

Mean and fluctuating velocity contours were determined for a convergent nozzle from surveys with impact pressure and piezoelectric pressure gauge probes, at Mach numbers of 0.6 to 1.4.

6. SPECIALIZED INSTRUMENTATION

3721. Fluorescence activated cell sorting - Bonner W.A., Hulett H.R., Sweet R.G. and Herzenberg L.A. - Dept. Genet., Stanford Univ. Sch. Med., Stanford, Calif. 94305 - REV.SCIENT.INSTRUMENTS 1972 43/3 (404-409)

An instrument has been developed for sorting biological cells. The cells are rendered differentially fluorescent and incorporated into a small liquid stream illuminated by a laser beam. The cells pass sequentially through the beam, and fluorescent light from the cells gives rise to electrical signals. The stream is broken into a series of uniform size drops downstream of the laser. The cell signals are used to give appropriate electrostatic charges to drops containing the cells. The drops then pass between 2 charged plates and are deflected to appropriate containers. The system has proved capable providing fractions containing large numbers of viable cells highly enriched in a particular functional type.

3722. Statistical analysis of position fixing general theory for systems with gaussian errors - Cooper D.C. - Dept. Electron. Electr. Engin., Univ. Birmingham - PROC.IEE 1972 119/6 (637-640)

The paper describes an extension of an earlier theory of position fixing in three dimensions, developed to permit the consideration of systems for which the positional errors of the position fixing planes are not statistically independent. The general theory is based on the assumption that the position selected is the 'maximum likelihood' point, and relatively simple expressions are derived from the mean square errors in the coordinates of this point. Covariance expressions are also derived. Two examples of possible practical systems are used to illustrate the value of the theory in system studies.

3723. Magnetically stirred, high pressure microreactor - Cerveny W.J. and Weitkamp A.W. - Res. Developm. Dept., Amer. Oil Co., Whiting, Ind. 46394 - REV.SCIENT.INSTRUMENTS 1972 43/6 (929)

A magnetically stirred, 14 cm^3, stainless steel reactor has been developed for studies up to 138 bar and 343°C. It is contaminant free and can be easily assembled, disassembled and cleaned. Construction details are given.

6.1. Metabolism

3724. An improved multiple unit constant pressure microrespirometer - Beltz A.D. and Reineke E.P. - Dept. Biol., Armstrong State Coll., Savannah, Ga. 31406 - J.APPL.PHYSIOL. 1972 32/6 (872-874)

An improved multiple unit apparatus which measures tissue respiration rates, with excellent reproducibility, has been extensively tested in teaching and research laboratories. The improved apparatus retains the advantages of the previous model, including the option of using various sizes of reaction vessels, but adds improved temperature control and a three way stopcock which releases pressures simultaneously on both sides of the manometer unit, thus reducing the chance of blowing the indicator fluid out of the manometer by mistake.

6.3. Digestive tract

3725. Mathematical model of the relationships between the electrolyte concentrations of gastric juice - MODELE MATHEMATIQUE DES RELATIONS ENTRE LES CONCENTRATIONS ELECTROLYTIQUES DU SUC GASTRIQUE - Ligny G. and Manouiloff J. - Dept. Gastroenterol. Lab., Hop. Civil, Charleroi - BULL.SOC.CLIN.HOP.CHARLEROI 1971 22/3 (95-102)

The mathematical relationships between the electrolyte concentrations of the gastric juice were studied as a function of the dilution of the acid secretion by the alkaline secretion, and as a function of its neutralization by bicarbonate. The influence of a loss of H^+ and Cl^- ions and of a supply of Na^+ ions is discussed. The influence of a loss of H^+ ions associated with an influx of Na^+ ions, as the manifestation of a diffusion phenomenon, is defined on the basis of the gradients of the electrolyte relationships and of the extrapolation values which they modify. In order to prove the existence of a diffusion phenomenon by a study of the relationships between the electrolytes H^+ and Na^+, it is essential to exclude contamination by saliva which alters the relationships in the same sense as diffusion. Investigation of the relationships between the electrolyte concentrations may make it possible to exclude the diffusion phenomenon and to define the changes in the composition of the parietal acid secretion. The modification of the relationships of the electrolyte concentrations under the influence of substances instilled into the stomach may reveal the diffusion phenomenon.

3726. Pressure measurements of articulatory behavior during alterations of vocal effort - Leeper Jr H.A. and Noll J.D. - Dept. Communicat. Disorders, Univ. Oklahoma Med. Cent., Oklahoma City, Okla. 73104 - ACOUST.SOC.AMER. 1972 51/4(II) (1291-1295)

A direct magnitude production scaling technique was employed to study the relationships of 3 speech variables: intraoral air pressure, lingual pressure, and sound pressure during changes in vocal effort. Selected CVC syllables containing 2 lingua alveolar stop consonants /t/ and /d/ were produced at various effort levels and during periods of increased auditory masking. Exponents of the effort function for intraoral air pressure and for lingual pressure (1.7 and 1.8, respectively) suggest that speakers can monitor effort during speech production. Exponents for production of sound pressure level (0.56) are similar to results of previous investigations. Systematically greater average values for /t/ contexts during both masked and nonmasked conditions distinguished intraoral pressure characteristics for consonants differing in force of articulation.

3727. Identification of stops and vowels for the burst portion of /p,t,k/ isolated from conversational speech - Winitz H., Scheib M.E. and Reeds J.A. - Univ. Missouri Kansas City, Mo. 64110 - ACOUST.SOC.AMER. 1972 51/4(II) (1309-1317)

Stimulus segments (burst, and burst plus 100 msec of vowel) were isolated from words with initial and final /p,t,k/, and presented to listeners for identification. For the burst alone, initials were identified better than finals and /t/ showed the highest level of identification. Also, in many instances vowels could be identified on the burst portions, giving perceptual evidence for coarticulation. With the additional 100 msec, the level of identification, as was expected, was high. Providing phonotactic context, in some instances, raised this level of identification.

3728. Ceramic root implantation in baboons - Hamner III J.E., Reed O.M. and Greulich R.C. - Exp. Pathol. Branch, Nat. Inst. Dent. Res., NIH, Bethesda, Md. 20014 - J.BIOMED.MAT.RES. 1972 6/4 (1-13)

When a human natural tooth is evulsed and lost, replacement by implantation of a replica would be one logical treatment choice. Identification of an appropriate biomaterial which would allow the replica to function in a stable manner without eliciting a toxic response is one of the major challenges facing dentistry today, and has been the subject of an increasing number of investigations in recent years. Because of questions which still remain regarding the biocompatibility of candidate materials, extensive animal research in tooth implantation is an absolute necessity. Primates, providing dental models closely approximating the human condition, are especially valuable for undertaking that systematic scrutiny of experimental implant materials which is so clearly prerequisite to human clinical trials. In the present study, 22 calcium aluminate roots were implanted into fresh natural tooth extraction sites in 10 baboons for periods ranging from 2 weeks to 10 months. The controlled porosity of the ceramic roots varied from 50 to 200 μ. Inplant retention and stability, resulting from adequate ingrowth of fibrous/vascular elements into the ceramic pores with subsequent mineralization therein of newly formed osteoid matrix, were optimal when the calcium aluminate root inplants had a porosity of 100 to 200 μ. Calcium aluminate root implants so successfully met all criteria of tissue adherence and host acceptance in the present short term study that their application in basic and clinical studies in man seem fully warranted at this time.

3729. Digital inverse filtering. A new tool for formant trajectory estimation - Markel J.D. - Speech Commun. Res. Lab. Inc., Santa Barbara, Calif. 93101 - IEEE TRANS.AUDIO ELECTROACOUST. 1972 AU-20/2 (129-137)

A new algorithm, based upon a digital inverse filter formulation, is presented and shown to be quite useful for estimating resonance or formant structure of voiced speech. The output of the algorithm is a set of raw data corresponding to peak frequencies versus time which is then used to estimate the first three and sometimes four continuously varying formant trajectories. Although an algorithm for automatically extracting the formants from the raw data is not presented here, for nearly 90% of the time an automatic decision algorithm is trivial, namely, the first three peaks of the reciprocal of the inverse filter spectrum define the first three formants.

3730. Speech recognized without computer - Editorial - ELECTRONICS 1972 45/12 (6E)

Work on electronic speech recognition has become more and more dependent on big computers. A team at Britain's National Physical Laboratory has developed a small system that doesn't need a computer at all. So far, the process can recognize six phrases. Using a computer to simulate further development (not as a permanent part of the system) it has been made to recognize 27 words: the numerals 0 to 9, the months of the year, and 'day', 'month', 'year', 'yes', and 'no'.

6.5. Blood

3731. Transfusion set with pump chamber for pressure transfusions - EIN NEUARTIGES TRANSFUSIONSGERAT MIT PUMPKAMMER ZUR DRUCKTRANSFUSION - Tauschinsky U. - Anaesth. Abt., Kreiskrankenh., Starnberg - ANAESTHESIST (Berl.) 1972 21/1 (32)

Pressure is generated by manual compression of the pump chamber in the portion of the transfusion apparatus leading from the pump chamber to the patient. The floating ball closes the pump chamber at the top and so prevents blood flowing back from the system under pressure into the drip chamber of the transfusion bottle. Air embolism is not possible in this system because if the pump chamber should be insufficiently filled, the floating ball can no longer shut the inlet opening on compression.

3732. Semiautomatic coagulation meter utilizing changes in viscosity - Dybkaer R. and Kuster H. - Geriat. Unit, Dept. Clin. Chem., De Gamles By, Copenhagen - SCAND.J.CLIN.LAB.INVEST. 1972 29/3 (265-269)

Drawbacks of previous machines are avoided by a new principle. When sol gel, viscosity increases, impeding passage of coagulating fluid through a constriction, augmenting the amplitude of forced pressure changes in a closed system of air in communication with the assay mixture; the resulting amplification of the movements of mercury in a U shaped manometer breaks a light beam, stopping a counter which was started at recalcification. The analytical variation is acceptable, and the bias differs very little from that of visual end point determination.

6.7. Circulation

3733. Electrocardiography in optical surgery - Egres J., Orban L. and Tasnadi G. - Dept. Ophthalmol., Munic. Hosp., Hatvan - MED.TECH. (Berlin) 1971 11/B-2 (10-12)

The authors using the mains operated electrocardiograph NEK 2 studied 50 patients undergoing ophthalmic operations in order to gather information on the oculocardiac reflex during eye surgery. They found that the oculocardiac reflex is less marked in local anaesthesia than in general anaesthesia. They therefore recommend local anaesthesia even as well as endotracheal anaesthesia.

3734. Physical influences on artificial pacemakers - FYSISCHE INVLOEDEN OP KUNSTMATIGE HARTGANGMAKERS - Tromp G.P., Van Eenige M.J., Brouwer F.A.S. and Schneider H. - Acad. Ziekenh., Exp. Lab., Klin. Hart Vaatchir., Utrecht - NED.T.GENEESK. 1972 116/12 (474-477)

Experiments were carried out in vitro and in vivo in order to study the influence of electromagnetic fields on atrium triggered, on demand and fixed rate pacemakers.

3735. Precision digital heart rate meter - James G.W., Paul M.H. and Wessel H.U. - Dept. Ped., Northwest. Univ., Chicago, Ill. 60614 - J.APPL.PHYSIOL. 1972 32/5 (718-723)

An ECG amplifier and precision heart rate meter was designed for use in exercise studies. The instrument meets the following requirements. Beat to beat determination of heart rate accurate to within one tenth of a beat over a range from 30 to 300 beats/min, fail safe triggering in the presence of motion artifacts, muscle noise, and respiratory QRS amplitude fluctuations as seen with severe exercise, digital display of instantaneous rate, and binary coded decimal output of rate and elapsed time for on line digital printout. To meet these specifications, the rate meter design utilizes preprocessing of the ECG signal to detect the R wave of the ECG and a completely digital algorithm to compute the instantaneous heart rate as the true reciprocal of each RR interval. The ECG amplifier provides a diagnostic ECG with a frequency response for 0.05-100 Hz. The filtered ECG used for R wave triggering has automatic gain control to minimize the effects of R wave amplitude change during exercise. Evaluation in over 100 exercise studies has shown extremely reliable operation, without requiring adjustments.

3736. Ferromagnetic silicone vascular occlusion in a superconducting magnetic field. Preliminary report - Rand R.W. and Mosso J.A. - Div. Neurosurg., Dept. Surg., UCLA Sch. Med., Los Angeles, Calif. 90024 - BULL.LOS ANGELES NEUROL.SOC. 1972 37/2 (67-74)

A procedure for occlusion of arterial vascular beds by injection of a ferrosilicone compound into feeding arteries via transcatheter or direct needle puncture technique is described. The application of a powerful superconducting electromagnet to the technique provides a means of confining the embolized iron silicone compound to the target organ. Toxicity studies of the iron and silicone compound were made in dogs. Application of this technique to the treatment of hypervascular neoplasms and aneurysms is discussed.

3737. Evaluation of aorto coronary bypass grafts with the Doppler ultrasonic flowmeter - Elkadi A., Lichti E.L., Sauer P.E. et al. - Sect. Thorac. Cardiovasc. Surg., Univ. Missouri, Columbia, Mo. 65201 - MISSOURI MED. 1972 69/5 (359-360)

Realizing the limitations of radiographic visualization, the authors recommend the Doppler ultrasonic flowmeter as a more effective tool for intraoperative and postoperative evaluation of aorto coronary bypass grafts. They cite the advantages of safety, simplicity, convenience and accuracy and the fact that the Doppler technique can be repeated anytime in the office or outpatient clinic.

3738. Spatio temporal measures of cortical functioning in normal and abnormal vision - Childers D.G., Perry Jr N.W., Halpeny O.S. and Bourne J.R. - Dept. Electr. Engin. Psychol., Univ. Florida, Gainesville, Fla. 32601 - COMPUTERS BIOMED.RES. 1972 5/2 (114-130)

Computer generated displays of scalp monitored spatiotemporal potential field patterns evoked by visual stimulation are used to demonstrate that dysfunctions in the visual system can be detected. Such dysfunctions may go unnoticed unless adequate spatial sampling is performed. Various display techniques are presented and discussed. These displays and similar techniques have application in the investigation of numerous and diverse electrophysiological phenomena.

3739. Macruz index and measurement errors: A critical evaluation - Valimaki I. - Med. Biophys. Bioengin. Res. Lab., Dalhousie Univ., Halifax - J.ELECTROCARDIOL. 1972 5/1 (96-98)

The Macruz index, the ratio of the duration of the P wave to that of the P-R segment (P-R segment = P-R interval minus P wave duration), reflects the relative balance of the right and left atrial excitation forces. Macruz et al. reported the normal range in adults to be 1.0-1.6; they considered <1.0 to imply right atrial enlargement and values >1.6 indicative of left atrial enlargement. In their original article, a mean index of 1.2 was calculated from Ziegler's data of normal P wave duration and P-R interval for children. Since then, widely varying normal values have been reported, especially in newborn and small infants; however, small errors in measurement may cause significant differences in the Macruz index.

3740. Precordial calibration - Zao Z.Z. - Res. Electrocardiol., Inc., Res. Div., Dayton, Ohio 45429 - J.ELECTROCARDIOL. 1972 5/1 (99-100)

The precordial calibration represents the development and clinical application of the experimental method which the late Doctor Frank N. Wilson utilized over 2 decades ago to construct the Burger triangle for individual subjects. It takes approximately 2 min to record the calibration in the Einthoven leads. The calibration is a graphic expression of the multi extracardiac factors of the subject that would distort his recorded electrocardiogram. Thus, a normal electrocardiogram associated with an abnormal precordial calibration may be abnormal, and an abnormal electrocardiogram associated with an abnormal precordial calibration may be normal.

3741. Interference sensitivity of implantable cardiac pacemakers - STOREMPFINDLICHKEIT IMPLANTIERBARER HERZSCHRITTMACHER - Blaser R., Dittrich H., Kirsch U. and Schaldach M. - Dept. Biomed. Techn., Univ. Erlangen Nurnberg - BIOMED.TECHN. 1972 17/3 (109-116)

A number of electrical apparatuses can be potentially hazardous to patients with implanted cardiac pacemakers (mains connected household articles, tooling machines, radar units, micro wave ovens and electrically driven public transport vehicles). A study was made of these factors and the effect of apparatus of different manufacturers. Only pacemakers which have a metallic screening device fulfil the necessary safety regulations. Because the maximally permitted interference density is often exceeded, the pacemaker must incorporate a device which automatically switches to a safe rhythm when the interference limits are reached. All pacemakers with a steel capsule are especially safe.

3742. Ultrasonic detection of bubbles with doppler flow transducers - Nishi R.Y. - Def. Civ. Inst. Environm. Med., Toronto - ULTRASONICS 1972 10/4 (173-179)

Doppler blood flow transducers have been used to detect gas bubbles in the circulatory system during hyperbaric decompression. This paper describes briefly the theoretical acoustic scattering properties of bubbles and then describes various experimental procedures which have been used to determine the properties of these flow transducers. The capabilities and limitations of the transducers for the detection of bubbles were investigated by studying the scattering from both solid objects and air bubbles moving through the acoustic field. In vivo experiments indicate that it would be difficult to obtain any correlation between the output of these transducers and bubble size.

3743. Sources of variation in clinical observations: problems of teaching and some results - Dixon R.A. and Johnston S.M. - Dept. Commun. Med., Univ. Sheffield - METH.INFORM.MED. 1972 11/3 (177-182)

The Wright peak flowmeter has proved a useful instrument to demonstrate to 4th year medical students in a 3 hr practical class the sources of random and systematic variation arising in biological measurements. A learning effect and both instrument and observer bias including terminal digit preference were analysed by the students using a desk top computer to carry out simple statistical routines. The differing requirements of reproducibility and precision in epidemiological and routine clinical use were discussed.

6.8. Respiration

3744. A non linear theory of the distribution of pulmonary ventilation - Pedley T.J., Sudlow M.F. and Milic Emili J. - Physiol. Flow Stud. Unit, Imp. Coll., London - RESP.PHYSIOL. (Amst.) 1972 15/1 (1-38)

A theory for the distribution of ventilation in a two compartment model of the lung is developed, neglecting inertial forces but allowing resistance and compliance to vary with lung volume and resistance to vary with flow rate, all in a non-linear manner. Numerical solutions to the basic equation are found for the distribution of inspired gas between the upper and lower lobes of erect human lungs. Results are presented to show how a bolus of labelled gas inspired at various volumes and flow rates would be distributed. The theory predicts the preferential distribution of the bolus to the lower lobes, if inspired slowly, because these lobes are more compliant than the upper as a result of the gradient of pleural pressure. With increasing inspiratory flow rate more of the inspired bolus is distributed to the upper lobes. Reversal, where ventilation per alveolus in the upper and lower lobes is equal after a given inspired volume occurs at approximately 2 litres/sec when the inspired volume is 400 ml. Above this flow there is a preferential distribution of gas to the upper lobes. This reversal is a direct result of the volume dependence of resistance, the more expanded upper airways having a lower resistance. The computations are made for a wide range of physiological and anatomical parameters, so that the influence of various factors, such as overall lung volume, airway resistance, and pressure volume relations, on the distribution of inspired gas, can be explored. The flow rate at which reversal occurs is influenced to some extent by all parameters but is most sensitive to changes in lung volume. The results are in good agreement with recent experiments on the distribution of gas using boli of radio active Xenon and external counters at the chest wall. It is stressed that the theory can readily be extended to calculate the distribution of ventilation in situations other than uniform inspiration, for example during cyclic breathing at various frequencies, if the appropriate anatomical and physiological variables for expiration can be determined.

3745. Voices of men and machines - Flanagan J.L. - Bell Telephone Labs, Murray Hill, N.J. 07974 - J.ACOUST.SOC.AMER. 1972 51/5 (I) (1375-1387)

Talking computers are likely to become a fixture in modern society. The range of information services that can be provided by voice from computers depends largely upon how clever computers become at imitating human speech. This, in turn, depends upon the fundamental acoustic and linguistic knowledge that can be imparted to the machine. This article summarizes the principles of human speech generation, traces some historical interests in speaking machines, and indicates present capabilities of talking computers.

6.9. Reproductive system

3746. Insertion of a silastic penile prosthesis for the treatment of organic sexual impotence - Pearman R.O. - Dept. Surg., Div. Urol., UCLA Med. Cent., Los Angeles, Calif. - J.UROL. (Baltimore) 1972 107/5 (802-806)

Malfunction of the phallus is not an uncommon complaint which requires a broad understanding of all possible etiologic factors if rational therapy is to be prescribed. Consultation with other medical disciplines is mandatory before surgical intervention is attempted. The insertion of a silastic penile prosthesis has proved of value in the treatment of organic impotence due to certain diseases, trauma and perineal or pelvic operation. The pushpull mechanism responsible for post traumatic curvature of the phallus is discussed. Certain aspects of Peyronie's disease and surgical correction of the curvature of the phallus produced by this malady are considered. Primary attack upon the end organ appears warranted in carefully selected cases of idiopathic impotence. The prosthesis serves only as a stent or crutch which enables the patient to insert the phallus into the vagina. It assists but does not replace the other factors necessary for successful copulation. It is of significance that no patient has asked that the prosthesis be removed.

6.11. Nervous system

3747. Carbon electrodes for stimulation of brain tissue in vitro - Nikander P. - Res. Lab., State Alcohol Monopoly (Alko), Helsinki - J.NEUROCHEM. 1972 19/2 (535-537)

The superiority of carbon electrodes over metal electrodes can be summarized as follows; no possibility exists of contamination by metal ions; a good geometric relationship is attained between electrodes, and the tissue section, which is advantageous for stimulation; and it should be possible to construct flow through chambers for kinetic studies by means of a parallel electrode arrangement.

3748. Three dimensional tremor measurements of the hand - Salzer M. - Inst. Arbeitswissensch., Techn. Univ., Darmstadt - J.BIOMECH. 1972 5/2 (217-221)

Measurements with a 3 dimensional accelerometer were made to find axes in which the tremor amplitudes are smallest or greatest, so that it is possible to limit the measurements of the tremor for a certain question to only one axis. It is shown that such axis are existing and can be found by anatomical physiological conclusions.

3749. A new runway for goldfish - Zych K.A., Raymond B., McHale M. and Wolach A.H. - Dept. Psychol. Educ., Illinois Inst. Technol., Chicago, Ill. 60616 - PSYCHOL.REC. 1972 22/1 (121-123)

A betta tank with a built in runway was developed. The apparatus permits housing goldfish in the same water that circulates in the runway. The Ss need not be removed from the runway for the duration of a study.

3750. A noise variance estimator in electroencephalography - Rey W.J.J. - Manufact. Belge Lampes Mater. Electron., SA, Brussels - COMPUTERS BIOMED.RES. 1972 5/2 (108-113)

it is hardly possible in the electroencephalographic field to distinguish the signal and the noise. What they are is for both of them so vague that very opposite views can be defended with success. Let us mention as extremes, on the one hand, the idea that a continuous electroencephalographic potential is noise due to the random like cephalic activity only and, on the other hand, the position of many who believe that no noise remains in an average evoked potential when the summation period is long enough. The present paper describes a method for the estimation of the noise variance based upon the following definition: the noise is the observation component behaving as a random variable. Special distribution is not postulated nor particular property of the random component. The estimator assumes implicitly some stationariness for the noise source, although this requirement has no practical importance. The application field of the method is mainly in the analysis of average evoked potential records where it is of interest to estimate the remaining noise component.

3751. Dialytrode for long term intracerebral perfusion in awake monkeys - Delgado J.M.R., DeFeudis F.V., Roth R.H. et al. - Dept. Psychiat., Yale Univ., New Haven, Conn. 06510 - ARCH.INT.PHARMACODYN. 1972 198/1 (9-21)

A method is presented for the establishment of long term electrical and chemical communication to and from the brain. The external dialytrode is formed by a push pull cannula ending in a small permeable bag, plus seven contacts spaced alongside. The transdermal dialytrode consists of a push pull cannula ending at one side on a permeable bag and at the other side on two puncturable reservoirs placed subcutaneously. In vitro experiments showed that the rate of passage of ^{3}H tyrosine through the dialytrode membrane was about 0.5% per hour. By applying positive or negative pressures, exchange rates of 2-4 μl/minute could be obtained. In vivo functional evidence of passage of chemicals was obtained in rhesus monkeys implanted with dialytrodes: perfusion of L glutamate (1 M) through the amygdala induced typical glutamate afterdischarges; aminoacids, such as glutamine, asparagine, serine, glutamate, glycine, and *a* alanine, were collected in amygdala perfusate; glycoproteins, such as fucose, mannose, glucose, galactosamine and galactose were collected in caudate nucleus perfusate; two way exchange, to and from the brain, was demonstrated by curves of washout and by local biosynthesis of amino acids from labelled glucose. Histological studies show good biological tolerance of dialytrodes and perfusion procedures. Transdermal dialytrodes remain functional for extended periods, are unobtrusive when not in use, and readily available when desired. This system may provide a new diagnostic and therapeutic procedure in man, to obtain neurochemical information from, and to deliver drugs to specific structures of the brain.

3752. An improved algesimeter for rats - Pfeiffer E.A., Menon M.K. and Aures D. - West. Res. Support Cent., VA Hosp., Sepulveda, Calif. 91343 - J.APPL.PHYSIOL. 1972 32/6 (875-876)

An improved algesimeter is described which uses thermal stimulation of the tail of the animal. By a careful design which uses a downdraft airflow for cooling, all convective heating of the tail could be avoided. Tests can be performed in rapid order without causing undue heating of the device. Some data on the effects of morphine HCl are given as an example.

3753. A simple and inexpensive stereotaxic apparatus - McClure W.O. and Anderson L.E. - Dept. Biochem., Univ. Illinois, Urbana, Ill. 61801 - REV.SCIENT.INSTRUMENTS 1972 43/5 (836-837)

A stereotaxi†available machine tool parts with a minimum of machining and expense. Placement of either electrodes or needles for injections can be carried out in the brain or spinal cord of cats, or other animals of similar size, with a precision of ±0.05 mm.

3754. Background activity of Purkinje cells in the intact and deafferentated anterior lobe of the cerebellar cortex of the cat - Arshavskii Y.I., Berkinblit M.B., Gel'fand I.M. et al. - Inst. Probl. Informat. Transm., USSR Acad. Scis, Moscow - BIOPHYSICS (Oxford) 1971 16/4 (709-717)

The paper presents a comparative analysis of the background activity of Purkinje cells in the intact and deafferentated cerebellar cortex of the cat. It is shown that deafferentation causes a small increase in the frequency and regularity of the work of the Purkinje cells chiefly through reduction in the percentage of long interpulse intervals. Consequently, the incoming afferent impulses exert a predominantly inhibitory influence on the spontaneous activity of the Purkinje cells. In study of the interaction of the adjacent Purkinje cells in the deafferentated cerebellar cortex, it is shown that they exert a reciprocal inhibitory influence on each other. This influence is apparently mediated by the return collaterals of the axons of the Purkinje cells. In the isolated cerebellar cortex, unlike the intact cortex, The authors never observed 'complex' action potentials of Purkinje cells.

3755. Reproduction by the respiratory centre of rhythmic stimulations of the medulla oblongata - Baron V.D. and Keder Stepanova I.A. - Inst. Probl. Informat. Transm., USSR Acad. Scis, Moscow - BIOPHYSICS (Oxford) 1971 16/4 (717-725)

In cats anesthetized with nembutal the authors have recorded the volume of the pulmonary ventilation, the activity of the respiratory neurones or the intercostal muscles and also the electromyogram of the diaphragm in response to stimulation at different points of the medial zone of the respiratory centre. It has been established that periodic stimulation of this zone with the period theta differing from the period of respiration T of the preparation in normal conditions makes it possible to impose on the respiratory system new thythmic modes of work. The steady stable mode of respiration on stimulation may be in the ratio 1:1 or 2:1 and sometimes 3:? to the set rhythm of stimulation. For all the points of stimulation investigated stable reproduction of rhythm was accompanied by the maintenance of the initial value of pulmonary ventilation. The experimentally established independence of the phenomenon of reproduction of rhythm on vagus afferentation and also the level of CO_2 in the inspired air suggests that of decisive importance in the effect decribed is the structure of the intrasystem links between neurones of the lateral and medial zones and probably the connexions of these zones with the neurones of the pons.

3756. The use of an EEG autoregressive model for the time saving calculation of spectral power density distributions with a digital computer - Pfurtscheller G. and Haring G. - Biomed. Engin., Techn. Univ., Graz - ELECTROENCEPH.CLIN.NEUROPHYSIOL. 1972 33/1 (113-115)

How an EEG autoregressive model can be constructed and the possibilities this offers for the calculation of the autocorrelation functions and hence the power density distribution are described. Thus, the use of an autoregressive model of a higher order permits a 30% shortening of time for the calculation single a greater number of amplitude values of the EEG. Together with the fast Fourier transform (FFT) this results in 95% saving of execution time compared with the usual method of calculating the power density distribution without model and FFT.

3757. A simple system for extracellular micro electrode recording from awake animals - Bridgeman B. - Dept. Psychiat., Stanford Med. Sch., Stanford, Calif. 94305 - ELECTROENCEPH.CLIN.NEUROPHYSIOL. 1972 33/1 (116-118)

An extracellular microelectrode recording system is described for use in unanesthetized cats or monkeys. The system is simpler than previous ones, can be built from readily available components without specialized tools or any machining of metal, and is so inexpensive that the microdrive itself is disposable. The heart of the system is a microdrive made from a 3 ml disposable hospital syringe, a standard machine screw and a length of fine wire. For recording it plugs onto an agar filled plexiglas cylinder which is implanted in the experimental animal along with ground and indifferent electrodes and head restraints. Recording wires lead not directly from the microdrve but from a removable plug which contains sockets for ground and indifferent leads as well as a field effect transistor head stage for conversion from high to low impedance. The high impedance leads are kept short, minimizing electrical noise. Ground, indifferent, and transistor leads go together from this plug to the amplifiers. For maximum experimental flexibility several microdrive mounting cylinders can be implanted successively or simultaneously. The system has been tested in cats and rhesus monkeys, where singele cells can be held for over an hour and several dozen cells can be recorded over several months from a single animal.

3758. Omnitrode: a simple cannula for chemical and bipolar electrical stimulation - Russell M.J., Godsey M.S. and Lydell K.W. - Stanford Res. Inst., Menlo Park, Calif. 94025 - PHYSIOL.BEHAV. 1972 8/4 (773-775)

A compact and easily built cannula that can be used for both chemical and bipolar electrical stimulation at the same brain site is described. This reusable cannula is made from inexpensive biologically inactive materials. It is small in size and requires no machining yet provides gold plated contacts for good electrical connections. It is useful for both dry and liquid microinjection of chemicals. The cannula is also recommended for multiple implantations.

6.12. Receptors

3759. Speech envelope cues as an acoustic aid to lipreading for profoundly deaf children - Erber N.P. - Cent. Inst. Deaf, St. Louis, Mo. 63110 - ACOUST.SOC.AMER. 1972 51/4(II) (1224-1227)

A speaker recorded lists of words on video tape. These lists were presented to normally hearing children and adults and to profoundly deaf children (average hearing threshold level greater than 95 dB ISO) for recognition through visual or combined acoustic visual (A V) modalities. For the normals, the acoustic stimulus was a 500 Hz octave band noise amplitude modulated by the envelope of the speech signal. For the profoundly deaf observers, the acoustic signal was either modulated noise or linearly amplified speech. Regardless of the type of acoustic signal they received, the mean A V scores of the deaf children were 7% to 11% higher than their mean visual scores. The normals also demonstrated small mean improvements (6% to 8%) over visual reception when allowed both to watch the speaker's face and to listen to modulated noise. These results suggest that profoundly deaf children perceive mainly time intensity (envelope) information when they are provided with an amplified speech signal.

3760. Frequency discrimination and the MLD - Gebhardt C.J., Goldstein D.P. and Robertson R.M. - Dept. Audiol. Speech Sci., Purdue Univ., Lafayette, Ind. 47907 - ACOUST.SOC.AMER. 1972 51/4(II) (1228-1232)

Binaural frequency difference limens in noise were obtained under homophasic and antiphasic conditions. Signal frequencies of 200, 300, 500, 700, and 1000 Hz were investigated at 5 and 10 dB sensation levels while 500 Hz was also explored at 15, 20, and 25 dB. The masker was a bandlimited noise with a spectrum level of 55 dB. Results indicate significant changes in discrimination behavior as a function of phase condition and sensation level. Alternative interpretations of the data are considered.

3761. The influence of rise time on loudness - Gjaevenes K. and Rimstad E.R. - Inst. Phys., Univ. Oslo - ACOUST.SOC.AMER. 1972 51/4(II) (1233-1239)

The influence of the rise time on the loudness of sound pulses and the meaning of the sound spectrum on this influence were examined. A 'paired comparison' method was used. The sound pulses had a duration of 0.7 to 1.0 sec and the rise time was varied between 0.03 and 1.0 sec. For most of the measurements, a signal level of 95 dB re 2 x 10^{-5} N/m^2 was used. The signals with the fastest onset showed the highest loudness. The influence of the rise time on the loudness was significantly dependent on the signal spectrum. The possibility of explaining the observed effects on the basis of changed synchronism of the neural activity and on the basis of a rapid adaptation in the nervous system is discussed.

3762. Hearing thresholds from toadfish, Opsanus tau, measured in the laboratory and field - Fish J.F. and Offutt G.C. - Ocean Scis Dept., Naval Undersea Res. Developm. Cent., San Diego, Calif. 92132 - ACOUST.SOC.AMER. 1972 51/4(II) (1318-1321)

Laboratory and field experiments are described in which toadfish hearing was investigated. The threshold to tonal stimuli determined in the laboratory using a conditional heart rate technique agreed closely with the field determined threshold using an unconditional behavioral response. Below 150 Hz, the hearing threshold was about 100 dB re 1 μN/m^2. Above 200 Hz, it increased rapidly at about 22 dB/oct. In addition to the tonal threshold experiments, a threshold to prerecorded playbacks of toadfish sounds was measured in the field. This threshold was about 15 dB higher than the tonal threshold in the same frequency range.

3763. Relative luminous efficiencies of the eye for near ir and uv laser light - Hamadani S.M. and Magyar G. - Europ. Space Res. Inst. (ESRIN), ESRO, Frascati - J.OPT.SOC.AMER. 1972 62/6 (830-831)

The authors report measurements which show that the relative luminous efficiency is the same for laser light as for incoherent light.

3764. Electroacoustic characteristics of hearing aids and sensorineural hearing loss - Martin M.C. - Roy. Nat. Inst. Deaf, London - SCAND.AUDIOL. 1971 sup.1 (99-108)

Whereas the acoustic performance of the hearing aid is essentially a linear one, the performance of the ear may be far from linear. The purpose of this paper is to examine the three parameters frequency response, gain and maximum output and attempt to assess their relative importance in cases of sensorineural hearing loss.

3765. A quantitative description of equilibrium and homeostatic thickness regulation in the in vivo cornea. I. Normal cornea - Friedman M.H. - Appl. Phys. Lab., Johns Hopkins Univ., Silver Spring, Md. 20910 - BIOPHYS.J. 1972 12/6 (648-665)

By combining a description of the couple solute and water flows through the in vivo cornea with a set of appropriate mechanical equilibrium conditions, it is possible to calculate directly the corneal thickness, given the corneal temperature, the state of the aqueous and tears, the swelling pressure hydration relation of the corneal stroma, and the transport properties of the corneal membranes. Active transport of ions or water by the corneal epithelium or endothelium, or both, are explicitly included. When published parameters are inserted into the formulation, the normal corneal thickness is recovered, and the corneal potential, anteriorly directed water flux, and stromal salt content are in reasonable to quantitative agreement with experiment. The analysis yields a simple physical explanation of the stromal imbibition pressure and the opposing forces which cause the cornea to assume its normal thickness.

3766. A quantitative description of equilibrium and homeostatic thickness regulation in the in vivo cornea. II. Variations from the normal state - Friedman M.H. - Appl. Phys. Lab., Johns Hopkins Univ., Silver Spring, Md. 20910 - BIOPHYS.J. 1972 12/6 (666-682)

The description of corneal mechanics and transport developed in part I and used there to describe normal corneal behavior is here applied to corneas whose properties or boundary conditions are abnormal. The predicted effects of changing intraocular pressure, aqueous concentration, and tear tonicity are examined, and these compare favorably with available experimental data. The periodic variation in tear tonicity which accompanies the sleep wake cycle prevents the cornea from achieving a true steady state, but a time average steady state, about which corneal behavior oscillates, can be defined. The in vivo effects of endothelial dystrophy and epithelial removal are explained, and it is suggested that the epithelial sodium pump may act homeostatically to maintain corneal thickness in the face of ambient temperature variations. Part II concludes with a discussion, from the standpoint of the present theory, of the role of metabolically coupled water transport in the maintenance of the normal corneal thickness.

3767. Design features of advanced scanning sonars based on modulation scanning. I - Voglis G.M. - Admiralty Res. Lab., Teddington - ULTRASONICS 1972 10/1 (16-25)

The performance characteristics of an 'ideal' scanning sonar are discussed and the general approach adopted for their incorporation in the design of the first advanced scanning sonar based on multistage modulation is detailed. The electronic implementation of the multistage system is described and the circuit arrangements employed are outlined schematically.

3768. Control of voice pitch by the deaf. An experiment using a visible pitch device - Boothroyd A. and Decker M. - Clarke Sch. Deaf, Northampton, Mass. - AUDIOL. (Basel) 1972 11/5,6 (343-353)

A visible pitch device was constructed around certain components of the Grason Stadler 1,200 series modular programming equipment. Using this device, 60 profoundly and very severely deaf children were given a pitch matching task involving the generation of fundamental voice frequencies at 3 different levels. The performance of the children was generally poor, very few of them having the necessary voluntary control of pitch. Performance was investigated in relation to other factors. Age appeared to be a significant factor in that older children performed better than younger ones, but no relation emerged between performance on the pitch matching task and sex, hearing loss, habitual pitch or speech intelligibility.

3769. Horizontal angle resolution by echolocating bats - Peff T.C. and Simmons J.A. - Audit. Res. Lab., Princeton Univ., Princeton, N.J. 08540 - J.ACOUST.SOC.AMER. 1972 51/6 II (2063-2065)

Echolocating bats were trained to discriminate between 2 small, spherical targets, each separated by a different angle from a third spherical target fixed in one location between the other targets. The targets were all in the horizontal plane. The angle from the fixed target to one of the movable targets was kept constant at 19° of arc, while the angle from the fixed target to the other movable target was varied from 37° to 19° in small decrements. The acuity with which the bat could use sonar to discriminate the larger angle from the smaller, constant angle of 19° was experimentally determined to be 6° to 8° for Eptesicus fuscus and 4° to 6° for Phyllostomus hastatus. Phyllostomus has a nose leaf through which it broadcasts its sonar cries, using a beamwidth (6 dB down) of 40° to 50° in this experimental setting. Eptesicus emits cries through its open mouth and, in the apparatus for angular discrimination, used a beamwidth of 55° to 65°. There are many other differences between these species in echolocation, but the data suggest that at least the width of a bat's beam of sound may be related to acuity of angular resolution.

3770. A simple method to rapidly advance microelectrodes into biological cells - Jay A.W.L. and Duncan R.I. - Div. Med. Biophys., Fac. Med., Univ. Calgary - REV.SCIENT.INSTRUMENTS 1972 43/6 (941-942)

A simple, inexpensive method to rapidly advance microelectrodes into biological cells has been developed. The system makes use of the pneumatic control feature of the de Fonbrune micromanipulator, which works on air bellows connected to the control joy stick by rubber air lines. A relay switch has been used to apply a small, reproducible, and accurately controlled amount of pressure on the rubber tubing concerned with the forward movement of the micromanipulator. The movements of the microelectrode are adjustable down to about 1μ and are sufficiently fast to cause penetration of the cell membranes without excessive deformation of the membrane or damage to the cell. The system has been used successfully to measure membrane potentials from human red blood cells as well as from nerve cells in culture.

3771. Crab's eye filter. Novel synthesis procedure for sets of band separation filters - Hills M.T. - Dept. Electr. Engin. Sci., Univ. Essex, Colchester -

PROC.IEE 1972 119/6 (641-648)

There are many applications in communication and instrumentation which require a bank of bandpass filters with adjacent passbands, such as telephone tone signalling systems, Doppler radar systems and speech analysis systems. By use of the technique of crossconnected feedback, these may be realised using a lower average number of critical components per filter channel than by existing procedures. The paper discusses the basic system and its analysis, and outlines some of the design procedures. There is also a discussion of the sensitivity of the system to component values. Some details are given of the practical application of this system to the tone receiver for use with pushbutton telephones. The name arises since the system was developed by analogy to the biological principle of lateral inhibition in the optical system of the Limulus crab.

6.13. Locomotor apparatus

3772. Electronic prosthesis for the upper limb. Preliminary report - PROTESIS ELECTRONICA PARA EL MIEMBRO SUPERIOR. COMUNICACION PRELIMINAR - Vales Ancona L.F. - Unidad Med. Trabajo, IMSS, Mexico City - REV.MED.INST.MEX.SEGURO SOC. 1971 10/2 (147-152)

A preliminary report about a new type of electronic prosthesis for the arm, operated by action currents generated on muscular contraction; at the same time a new type of socket is described which dispenses with the ordinary means of suspension by a jacket and straps. Indications and contraindications for the prosthesis and its accessories are described; physiotherapy and a competent team for habituating the patient to the prosthesis are necessary.

3773. A loudspeaker servo system for use in studying muscle mechanics - Clinch N.F. and Tennant V.A. - Univ. Alberta, Edmonton - J.APPL.PHYSIOL. 1972 32/5 (703-705)

A loudspeaker was modified for use in controlling muscle length for the study of muscle mechanics and was incorporated into a feedback loop to ensure correspondence between input voltage and muscle length changes. Such a system permits more flexibility in choice of experimental mechanical conditions than does a combination of weights, stops, dampers, and so on, since electrical signals of various forms are readily generated, and in this system muscle length follows closely the input voltage.

3774. Independent dressing and undressing with a foot controlled manipulator for bilaterally arm paralysed patients - Fallstrom C.E. and Andreasson S. - Dept. Neurol. Rehab., Sahlgrenska Sjukh., Goteborg - SCAND.J.REHAB.MED. 1971 3/4 (183-185)

One of the authors is totally paralysed in both arms by poliomyelitis. He has constructed a foot controlled manipulator which makes it possible for him to dress and undress without the help of another person. The technique is described. Good function of trunk and legs is required.

3775. Vitreous carbon percutaneous electrodes for muscle stimulation - Gibbons D.F., Peckham P.H. and Martin R.L. - Cent. Study Materials, Inst. Pathol., Case West. Reserve Univ., Cleveland, Ohio 44106 - J.BIOMED.MAT.RES. 1972 6/4 (155-164)

In vivo and in vitro tests have demonstrated that vitreous carbon anodes are corroded when operated under conditions typical of those used for the physiological stimulation of muscle. Similar electrodes are completely inert under cathodic conditions. The chronic stimulation experiments demonstrate acute and chronic inflammation with increased vascularity in the tissue adjacent to an anode.

3776. The response of joints to impact loading. II. In vivo behaviour of subchondral bone - Simon S.R., Radin E.L., Paul I.L. and Rose R.M. - Dept. Orthop. Surg., Harvard Med. Sch., Child. Hosp. Med. Cent., Boston, Mass. 02115 - J.BIOMECH. 1972 5/3 (267-272)

The knee joints of live guinea pigs, subjected to repeated longitudinal impaction, developed obvious cartilage degeneration over a 3 week period. In vitro tests had previously shown that articular cartilage is particularly susceptible to injury from impact loading and that subchondral bone acts as a cushion to protect the overlying cartilage from damage during such loading. Associated with, and slightly preceding the earliest cartilage changes, as judged histochemically, was a stiffening of the underlying subchondral bone. The bone stiffness measurements returned to within the normal range as the cartilage degeneration progressed.

3777. Measurement of momentary velocity in a study of human gait - Molen N.H. and Boon W. - Inst. Biomech. Rehab., Free Univ., Amsterdam - J.BIOMECH. 1972 5/3 (273-276)

This study describes a method of measurement in the field of biomechanical research, which determines the walking speed of the subject in a forward movement. The measuring is based on the procedure of a subject stretching a magnetic tape, while it runs through a playback head. Pulses have been fed into the tape in advance so that the signal frequency is proportional to the momentary walking speed of the subject in the course of movement. In a frequency/d.c. converter, the signal frequency is converted into a proportional d.c. voltage. The frequency response of the output signal is being analysed and compared to the frequency response obtainable in a speed measuring system in which a tachogenerator is applied.

3778. Application of a hybrid analog computer of little calculating capacity to the control of feedback signalers by the electromyogram amplitude - EINSATZ EINES HYBRID ANALOGEN LABORRECHNERS MIT KLEINER RECHENKAPAZITAT ZUR ANSTEUERUNG VON RUCKMELDE SIGNALGEBERN DURCH DIE ELEKTROMYOGRAMM AMPLITUDE - Radl G.W. - Inst. Unfallforsch., TUV Rheinland, Koln - BIOMED.TECHN. 1972 17/3 (96-102)

The automatic display of muscle relaxation can be used in therapy for neuralgias generated by muscle tension. The experimental equipment used included an analog computer. In this paper initially the basic functional principles of analog computers are described. Then its major uses in biological sciences and its advantages and limitations are enumerated. Finally different circuits for the EAI 180 laboratory computer are described, which are used for controlling optical and auditory displays by EMG amplitude. The criteria for relaxation feedback can be programmed by the experimentor: the actual status of muscle tension of a specific muscle group can be used as input of the circuit as well as the gradient from muscle tension to relaxation, both obtained by EMG skin electrodes.

6.15. Aerospace medicine

3779. Electronic control to ensure constant infusion rate - ELEKTRONISK KONTROLLENHET FOR KONSTANT INFUSIONSHASTIGHET - Gundersen J. - Dept. Surg., Univ. Hosp., Malmo - LAKARTIDNINGEN 1971 68/47 (5457-63+79)

The infusion rate of blood or other solutions is generally adjusted by varying the height of the bottle or changing the degree of constriction of the tube to the patient. For many reasons, it has hitherto been difficult to obtain a constant infusion rate during prolonged treatment. An electronic device designed for this purpose is described. It consists of a drop counter and a constriction gap for the tube controlled by a motor. The drop rate can be set to between 3 and 99 drops/min. The device was found to be reliable within a range of 5%, and of great value in infusing drugs of which the blood concentrations had to be kept constant, i.e. those regulating blood pressure, coagulation and uterine contractions. It is also of special value for infusions in premature infants. An analysis of the drop volume at different infusion rates shows that this is constant in only 2 out of 10 solutions most commonly used for infusion. In the rest, the number of drops per ml. decreases with a rising infusion rate. For accurate administration, this factor should also be taken into consideration. Shunting of the fluid along the walls of the drip chamber may occur if the dome of the chamber is too narrow or if the drop pipe is too short. Shunting is most likely to occur in solutions containing proteins. This may cause bubbles to emerge, if they are situated between the drop pipe and the wall, shunting may occur. As the shunted volumes may be several times larger than those falling as drops, this error may seriously influence the accuracy. It is suggested that all drop chambers should be made shunt proof. This may be done simply by increasing the width of the dome of the drip chamber and the length of the drop pipe. The use of metal drop pipes especially reduces the risk of shunting.

3780. Accelerations acting on brain structures during movements of the head - Krut'ko V.N. - Moscow Phys. Techn. Inst., Moscow - BIOPHYSICS (Oxford) 1971 16/4 (768-771)

As a result of averaging of the values of the accelerations acting on given points of the brain for different movements of the human head, a formula for the mean values of the accelerations observed at these points and isolated regions with uniform mean accelerations is obtained.

6.16. Work and sport

3781. Problems of car usage for elderly people. An ergonomic study concerning car door size - Hook O. and Von Heijne C. - Inst. Rehab. Med., Univ. Goteborg - SCAND.J.REHAB.MED. 1971 3/4 (178-182)

Seventy seven persons with an average age of 68.4 yr were tested with respect to their ability to get in and out of an automobile. Fifty (65%) of the subjects could get in and out with a normal door size (Volvo 144) without great difficulty and with only slight assistance. The changes of the door size which, generally, best facilitated the subject's entry was an increase in width of 10 cm combined with removal of the threshold. After this change, 70 persons (91%) could get in and out of the automobile without great difficulty. Nine persons in the group tested could not enter the automobile when the door had standard measurements, though after the change mentioned above, 6 of these 9 subjects could enter with only slight assistance.

6.17. Radiology

3782. Highsensitive miniature TSEE dosimeter - NAGY ERZEKENYSEGU MINIATUR EXOELEKTRON DOSIMETER - Boros L. - Radiol. Klin., Semmelweis Orvostud. Egyet., Budapest - MAGY.RADIOL. 1971 23/5 (257-262)

The sensitivity of miniature BeO ceramic TSEE dosimeters has been extended by 2 orders of magnitude to the lowest detection limit of 1 μR, applying a new procedure. The dosimeters are of energy and angular independence, the dose response ratio is linear and proportional in the dose range of 5 orders of magnitude. Their application is especially advantageous in the field of micro dosimetry, in vivo dosimetry and dosimetry of low energy rays.

3783. Scintillating chambers and their employment in nuclear medicine - CHAMBRES A ETINCELLES ET APPLICATION A LA MEDECINE NUCLEAIRE - Lansiart A. - Serv. Electr. Phys., Cent. Et. Nucl., Saclay - ANN.PHYS.BIOL.MED. 1971 5/4 (187-204)

With the restrictive image of an apparatus filled with gas and producing sparks, one must bear in mind that the detection by the gas may give good yields but that the area of use in X and γ is limited and that the detection by the wall effect makes it possible to cover a wide energy range with yields below 100%. These devices do not allow good energy discrimination. They are of simple design. Evidence is presented that in the field of X-rays certain chambers give images of superior quality to the scintillation devices now in use.

3784. The extrafocal radiation of rotating x ray

anode tubes and its influence on the image quality - DIE EXTRAFOKALE STRAHLUNG VON RONTGENDREHANODENROHREN UND IHR EINFLUSS AUF DIE BILDQUALITAT - Kuhn H. and Gajewski H. - Bereich Med. Techn., Siemens Aktiengesellsch., Erlangen - SIEMENS ELECTRO MED. 1971 39/4 (125-131)

The effect of the extrafocal radiation of X-ray tubes is mainly recognizable by blackened strips along the sides of the field outlined by the depth diaphragm, if the edges of the latter are in the immediate vicinity of the contours of the object. A report is given on various measurements of the extrafocal irradiation as a percentage of the total radiation emitted by a rotating anode X-ray tube, with and without depth diaphragm. The impairment of contrast theoretically expected due to the extrafocal radiation in the field of view is practically invisible on X-ray photographs taken with an intensifier screen, because it is negligible in relation to the much greater reduction of contrast due to scattered radiation. However, with image intensifier photographs an impairment of contrast may result if extrafocal radiation passes the object without attenuation and illuminates the input screen of the image intensifier outside the field of view proper. A series of photographs shows that with image intensifier photographs very careful masking or elimination of 'haze' in the object is particularly important.

3785. The use of automatic injection syringes for selective coronarography. Description of a new injection technique used free or coupled to an electrocardiograph - UTILISATION DES SERINGUES A INJECTION AUTOMATIQUE EN CORONAROGRAPHIE SELECTIVE. A PROPOS D'UNE NOUVELLE TECHNIQUE D'INJECTION LIBRE OU COUPLEE A L'ELECTROCARDIOGRAMME - Ecoiffier J., Bonnemazou A., Chermet J. and Merlan J.J. - Serv. Radiol. Vasc., Hop. Broussais, Paris - ANN.RADIOL. 1972 15/5-6 (499-509)

The authors describe on the basis of 185 cases, their technique for performing selective coronary arteriography using an automatic injection syringe, either alone or coupled with en ECG. All investigations were carried out using preformed catheters via the femoral percutaneous route. Radiocinematic studies were performed in all cases complemented in 79 patients by seriography.

3786. Image communication by telephone - Webber M.M. and Corbus H.F. - Saint Agnes Hosp., Fresno, Calif. - J.NUCL.MED. 1972 13/6 (379-381)

The investigators evaluated a slow scan video system capable of transmitting static nuclear medicine scan images over the telephone line. The system was found to have potential for future applications in bringing nuclear medicine services to small, remote hospitals. The results of this study indicate that no positive examinations were misread. However, there was a tendency for television interpretation to be equivocal or positive when direct interpretation was negative. It was felt that the difficulties which were encountered in this initial use of the system could be overcome.

3787. Fresnel zone plate imaging in nuclear medicine - Barrett H.H. - Raytheon Res. Div., Waltham, Mass. 02154 - J.NUCL.MED. 1972 13/6 (382-385)

The author has shown that a Fresnel zone plate aperture permits the recording of a gamma ray image in a coded form, analogous to a hologram, but with an enormous increase in gamma ray collection efficiency compared to a pinhole or collimator. This advantage can be used by the physician to either reduce the administered dose of radiopharmaceuticals or to decrease the time required to obtain an image. The practicality of the scheme has been demonstrated for small objects such as the thyroid gland. For high resolution imaging of large objects, such as the liver, there are definite limitations which will be delineated more carefully in forthcoming publications. Future research in this field should include the investigation of other possible aperture codes and associated decoding methods, extension to other types of radiation, and most importantly, clinical evaluation.

3788. The silicon storage tube: a new method of image storage in fluoroscopy - Mistretta C.A., Ort M.G., Cameron J.R. and Moran P.R. - Princeton Electron. Prod., New Brunswick, N.J. - INVEST.RADIOL. 1972 7/3 (174-176)

A relatively inexpensive fluoroscopic storage system was constructed using an electric in - electric out silicon image storage tube. This nonmechanical tube with its biasing and deflection circuitry is commercially available in a compact, portable unit. Using synchronization and switching circuits the authors constructed, this storage system can be linked to an existing fluoroscopic TV installation in minutes. In the simplest mode of operation, the last image is retained and continuously displayed on the monitor (or on a second monitor) after the radiologist turns off the X rays. This permits viewing of the stored image without additional X ray exposure to the pat[illegible] and personnel in the examining room. Circuitry was developed that permits superimposing live and stored images as well as subtracting one image from another. The storage system's characteristics and some of the possible clinical applications are discussed.

3789. Short target film rotating grid magnification. Comparison with air gap magnification - Bookstein J.J. and Powell T.J. - Dept. Radiol., Univ. Michigan Med. Cent., Ann Arbor, Mich. 78104 - RADIOLOGY 1972 104/2 (399-402)

Two techniques of direct magnification radiography are compared: standard magnification using a 40 cm air gap to reduce scatter, and short target film (STF) magnification using a 55 cm target film distance and a rotating grid to reduce scatter. Both techniques provide nearly equal resolution, although STF magnification is slightly superior in this respect. The advantages and disadvantages of STF magnification are discussed.

3790. A flexible grid air gap magnification technique - Moore R., Krause D. and Amplatz K. - Div. Hlth Computer Sci., Dept. Lab. Med., Univ. Minnesota Sch. Med., Minneapolis, Minn. 55455 -

RADIOLOGY 1972 104/2 (403-407)

A combination grid air gap magnification technique, used routinely for a large group of patients, offers a more flexible approach to clinical magnification angiography. Low ratio grids permit a shortened target film distance, allowing maximum secondary radiation dissipation with minimal primary beam attenuation. The degree of primary radiographic magnification is adjustable, motion unsharpness minimized, and cross fogging (the bane of biplane cerebral angiography) is eliminated altogether. An expected disadvantage, of course, is a somewhat increased patient dose.

3791. Dry probe ndt - TekTran, Newark, Ohio 43055 - ULTRASONICS 1972 10/4 (151)

A dry roller ultrasonic probe has been developed to eliminate the need for liquid acoustic couplants. The probe, made by Tek Tran, consists of a roller transducer with a special dry coating, which, its manufacturers claim, matches or exceeds the sensitivity of conventional 'wet probes'.

3792. Stability and synthesis of two dimensional recursive filters - Shanks J.L., Treitel S. and Justice J.H. - Res. Cent., Amoco Product. Co., Tulsa, Okla. 74102 - IEEE TRANS.AUDIO ELECTROACOUST. 1972 AU-20/2 (115-128)

Two dimensional recursive filters are conveniently described in terms of two dimensional z transforms. The designer of these filters faces two fundamental problems, their stability and their synthesis. Stability is determined by the location of the zero valued region of the filter's denominator polynomial. A conjecture based on a one dimensional stability theorem leads to a useful empirical stabilization procedure. Two dimensional recursive filters can be synthesized to approximate large varieties of desired two dimensional pulse responses. A conformal transformation yields two dimensional recursive bandpass filters from appropriately specified one dimensional filters.

3793. Grid coding: A novel technique for image processing - Will P.M. and Pennington K.S. - IBM Thomas J. Watson Res. Cent., Yorktown Heights, N.Y. 10598 - PROC.IEEE (N.Y.) 1972 60/6 (669-680)

The encoding of information as the modulation of a grid is explored as the means for allowing the extraction of relevant details or features from images. A major aspect of this approach is the replacement of the heuristics in certain image processing tasks by simple Fourier filtering. Specific examples and particular implementations of coding schemes are described in order to show the wide applicability of the concept. The examples chosen fall in the domains of scene analysis, difference extraction from successive images, automatic extraction of range, extraction of features such as planes, recording of three dimensional imagery, and the processing of a single coded view to give a set of stereo related pairs.

3794. Pyroelectric thermal imaging devices - Putley E.H., Watton R. and Ludlow J.H. - Roy. Radar Establishm., Malvern - IEEE TRANS.SON.ULTRASON. 1972 SU-19/2 (263-268)

Study of the pyroelectric properties of a number of ferroelectric materials has shown that they can be used as sensitive infrared detectors suitable for use in thermal imaging systems. In particular when single domain triglycine sulphate elements of adequate quality are used, the detectivity obtained approaches within an order of magnitude of an ideal thermal detector. It is also possible to use TGS as the target in an infrared camera tube similar in general construction to a conventional vidicon. Two types of thermal imaging system are described. The first uses a linear array of TGS detectors in combination with a silicon integrated circuit signal processing system. The second employs the pyroelectric infrared camera tube.

9. COMPUTER APPLICATIONS

3795. Computer approaches to protein structure. IV. Control tapes for polypeptide synthesis - Tometsko A.M. - Dept. Biochem., Univ. Rochester Med. Cent., Rochester, N.Y. 14642 - COMPUTERS BIOMED.RES. 1972 5/2 (156-165)

The use of tape reading instruments for the solid phase synthesis and/or solid phase Edman degradation of polypeptides and proteins has created a need for fast and reliable methods of generating control tapes. A computer program is described which generates a single control tape for the simultaneous synthesis of two proteins. With this program, the investigator specifies the desired amino acid sequences and the computer, through the program, generates a command array for the complete synthesis of the proteins. As a result, the control tape for weeks of instrument operation, and therefore weeks of chemical synthesis, is available in minutes. Knowledge of computer programming is not essential to generate control tapes with the described program.

3796. Computer analysis of transcranial sonotomographic B scans - King J.C. and Wong A.K.C. - Biotechnol. Prog., Carnegie Mellon Univ., Pittsburgh, Pa. 15213 - COMPUTERS BIOMED.RES. 1972 5/2 (190-204)

A computerized system for analyzing transcranial sonotomographic B scans is introduced. The digitized tomogram is first enhanced to overcome the resolution and distortion problems now inherent in the B scan. Any abnormal echoes in the scan are then located and various ultrasonic features are extracted for measuring. Using these measurements, a trainable pattern classifying scheme is devised to establish the decision criteria for measuring membership of the abnormal echo in a tumor class. This system demonstrates the potential of computerized B scan tomograms for an automated diagnostic scheme.

3797. Wiswesser line notation: Simplified techniques for converting chemical structures to WLN - Koniver D.A., Wiswesser W.J. and Usdin E.

- Div. Computer Res. Technol., NIH, Bethesda, Md. 20014 - SCIENCE 1972 176/4042 (1437-1439)

Techniques have been developed for the generation of Wiswesser Line Notations (WLN), which require knowledge neither of rules for manual conversion of structures to line notations nor of computer programming. The desired WLN are obtained simply by drawing the structures of the compounds of interest on a tablet, which is linked to an appropriately programmed computer.

9.1. Hospital automation

9.1.1. Laboratory techniques

3798. Identification of barbiturates by computerized mass spectrometry - Bonnichsen R., Fri C.G., Hedfjall B. and Ryhage R. - Lab. Mass Spectrometery, Karolinska Inst., Stockholm - Z.RECHTSMED. 1972 70/3 (150-156)

A computer was used for rapid and exact identification of mass spectra for the barbiturates presently on sale in Sweden. The compounds were isolated from blood, or liver from intoxicated persons in suicide cases and a small part of the chloroform extracts were analyzed on a gas chromatograph mass spectrometer instrument. The mass spectra were recorded on a digital tape off line system and the tape was evaluated and processed by the computer. The amount of tissue or blood was in the magnitude of less than 50 mg in these cases.

3799. A computer program for estimation of creatinine clearance from unstable serum creatinine levels, age, sex, and weight - Jelliffe R.W. and Jelliffe S.M. - Univ. South. California, Sch. Med., Los Angeles, Calif. 90033 - MATH.BIOSCI. 1972 14/1-2 (17-24)

Quantitative appraisal of renal function has been difficult when reliable urine collections from patients cannot be obtained for measurement of endogenous creatinine clearance (CCr) by standard methods. Previous estimates of CCr from data of stable serum creatinine have been reasonably accurate for clinical purposes. A reappraisal of this data, coupled with a dynamic model of creatinine kinetics in patients, has led to a method to estimate CCr even when serum creatinine levels and renal function are rapidly changing. A computer program has been written for a hospital based time shared terminal to estimate CCr in this manner.

9.2. Medical history

3800. Criteria for comparing various systems of classification - VERGLEICHSKRITERIEN UNTERSCHIEDLICHER KLASSIFIKATIONSSYSTEME - Hopker W.W. - Abt. Dokument. Histor. Soz. Pathol., Pathol. Inst., Univ. Heidelberg - METH.INFORM.MED. 1972 11/3 (144-151)

Conventional coding and classification systems in medicine will retain their justification even in the future, especially in the international field. The decision to use a certain system of classification should not be based on objective and semantic grounds only. Other comparative criteria should be applied to the code and the coding process in order to insure that coding is made as easy and straightforward as possible. The additional criteria will make it possible to describe the structural qualities of the various classification systems and to separate them from each other. The studies are based on 2 prerequisites. According to certain criteria, the grouping shown by the arrangement of the classification systems is used to define a 'class'. The numerical size of each class is arranged according to rank and is shown for each code separately. A comparison of the curves of these rank numbers between the different codes supplies the first evidence for their classification structure. The theoretical concepts, such as information, entropy, and redundance, are discussed and applied to those codes now in use nationally and internationally. The values obtained yield comparative criteria such that a measure can be given for the information on the grouping of a classification system. The measure, however, cannot be derived from the contents of the preferred terms listed in the codes. The measure may be looked upon as an expression of applied criteria for classification and grouping. There is no information as to the frequency of the use of the codes and their preferred terms. For this reason it is not possible, although it would be desirable, to calculate differentiated informational quantities of a theoretical nature.

9.3. Clinical diagnosis

3801. Computer aided diagnosis of goitres in a cancer department - Bouckaert A. - Lab. Physiopathol., Fac. Med., Lovanium Univ., Kinshasa - INT.J.BIOMED.COMPUT. 1972 3/1 (3-15)

Computer aided differential diagnosis of goiters in a cancer department was performed using Bayes's theorem. The use of partial data reveal that the clinical signs are the mose useful, this being particularly true for the diagnosis of cancer. Entropy is used here for defining acceptability criteria for the results of computer diagnosis.

9.10. Function tests and techniques

3802. Computer monitors women in labor - ELECTRONICS 1972 45/9 (40-41)

A fetal monitoring system based on pattern recognition and labor progress checking by a computer is mentioned. Preliminary results show a good correlation between computer diagnosis and clinical diagnosis.

3803. Digital simulation analysis of biophysical systems - Huang B.K. - Dept. Biol. Agric. Engin., North Carolina State Univ., Raleigh, N.C. - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (128-139)

In the study of biophysical systems, the need for simulation often arises because a system may be better defined by assuming that the simulation model characterizes certain properties of the real system. Techniques of digital simulation and dynamic analogies, which offer much greater possibilities for quantitative analysis and synthesis of complex biological and physical systems, have become important and versatile tools. The advent and development of problem oriented computer languages have made the simulation analysis a convenient and powerful method of problem solving and design in the diversified fields of biological engineering. Practical guides to the idealization, simplification, formulation, and analysis of biophysical systems, as well as application of computer simulation models and routines, are discussed.

3804. High pressure state simulation studies as an aid to understanding diving problems - Mackay R.S. - Dept. Biol. Surg., Boston Univ., Boston, Mass. - IEEE TRANS.BIOMED.ENGINEERING 1972 BME-19/2 (140-143)

Some of the earliest biological system models used to guide the affairs of man were employed to avoid the 'bends' in diving. A brief discussion of decompression sickness, as it can affect tunnel workers, airplane pilots, or divers, is given, along with an analog computer configuration to represent the situation. The configuration itself has proved helpful in aiding engineers to understand some of the mechanisms involved, and the recordings that result seem helpful in supplying to physiologists and divers a feeling for the probable effect of a change in circumstances associated with a proposed dive. The effect of changing a gas mixture or changing the time course of a dive is readily visualized, for example, as are the results of using a continuously variable gas mixture and continuous ascent for minimum decompression time.

3805. Computerised system for scintigraphy - Beckman K.W., Berne E., Liljenfors B. and Vikterlof K.J. - Radiat. Phys. Dept., Regionsjukh., Orebro - ACTA RADIOL.SER.DIAGN. 1972 Sup.313 (193-198)

Many different procedures are used for enhancing the interpretation of scans. The development of small economic computers has opened up new possibilities of improving the analysis of scans. Such a system is described which offers the possibility of working in an off or on line system in rectilinear scanning. The data may either be digitally printed out or presented on a TV display and photographed. The presentation may also be made on a color TV display. Normally the scan is presented in a 64 x 64 matrix. When making 2 registrations, e.g. for pancreas scan, this matrix may be divided into 2 separate matrices and the required subtraction of one activity from the other, point by point, using a preselected factor may be performed. The clinical experiences with the equipment are encouraging. It is fast and simple to handle for the personnel.

9.10.1. Blood circulation

3806. Computerized monitoring of cardiac output by thermal dilution - Ellis R.J., Gold J., Rees J.R. and Lillehei C.W. - Dept. Surg., New York Hosp. Cornell Med. Cent., New York, N.Y. 10021 - J.ASS.ADVANC.MED.INSTRUMENT. 1972 6/2 (116-121)

The thermal dilution technique has been developed for clinical use. Room temperature saline is injected via the subclavian vein, and the temperature change is recorded by the thermistor in the pulmonary artery; cardiac output is read off immediately. Cardiac outputs can be determined as frequently as every 20 sec using saline injections of 7 to 10 cc for each determination. Consistency is in the range of less than 100 cc differences between sequential determinations. The experience has demonstrated that the thermal technique is very reliable, and that it can be used in acute clinical situations with ease and excellent reproducibility.

3807. Real time cardiovascular data sampling - Winchester B.T. - Dept. Physiol., Fac. Med., Univ. Toronto - CARDIOVASC.RES. 1972 6/3 (302)

A method for real time partitioning of the cardiac cycle into N equal duration intervals was devised to facilitate digital sampling for computer analysis of cardiovascular data. The particular application is in dividing the cardiac cycle into radix two intervals in order to apply the 'Fast Fourier Transform' algorithm of Cooley and Tukey (1965) to the data.

9.10.3. Nervous system

3808. Analysis of epileptics (use of deep electrodes) using an electronic computer - Adams J. and Kahm L.B. - Univ. California Med. Cent., San Francisco, Calif. - J.BIOMED.SYST. 1971 2/8 (3-17)

This paper presents a method of locating foci of individual frequency components in the depth recorded electroencephalogram. Signals from appropriately spaced depth electrodes constitute the computer input. The computer can deliver the tree dimensional stereotaxic coordinates of each foci of interest in the surgical treatment of epileptic patients.

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423 Bugliarello G.

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323 Freytag E.

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1899 Ichijo B.
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Section II: **Application of Optical Diffraction and Image Reconstruction Techniques to Electron Micrographs** by R. W. HORNE, John Innes Institute, U.K.

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Section II: Introduction. Light sources. Lens requirements and construction of an optical diffractometer. Image reconstruction. The interpretation of optical diffraction patterns. Calibration requirements and test objects. Optical diffraction patterns from the conventional light microscope: convolution camera: commercial optical diffractometers. The enhancement of image detail in electron micrographs by photographic methods. Computer processing of images and diffraction patterns. Appendix. List of suppliers. Subject index.

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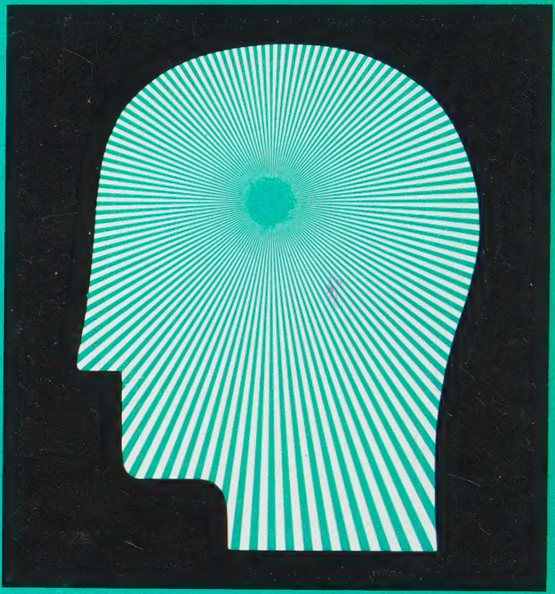

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